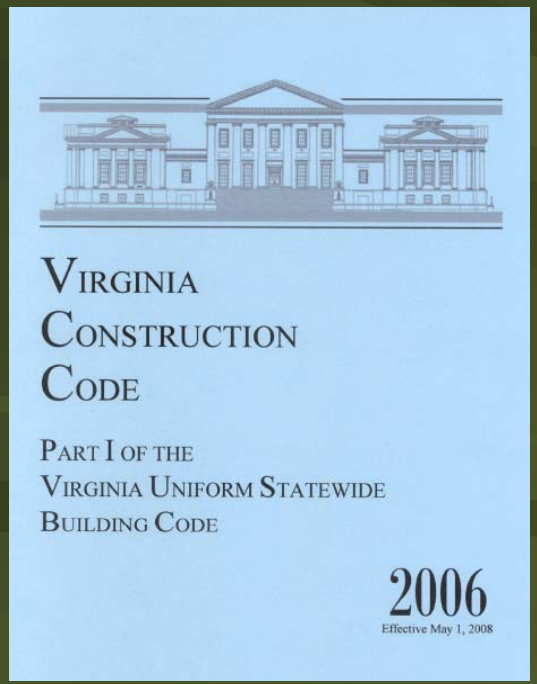
Welcome to the Update of the 2006 International Residential Code - Energy Conservation Provisions

Presented by the Chesterfield County Department of Building Inspection

Presentation Team Members

- Inspections Division
  - Barry White, Inspections Supervisor, Energy Czar
- Residential Plan Review Division
  - James Cale
  - Eddie Dunlevy

Part I of the Virginia Uniform Statewide Building Code – The Virginia Construction Code



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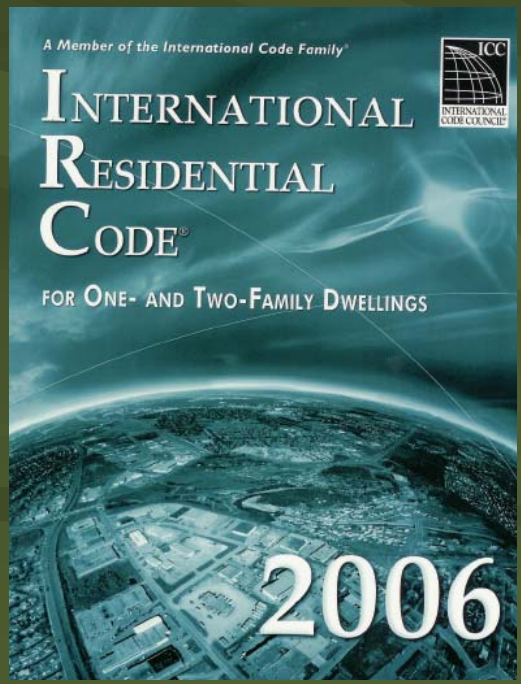

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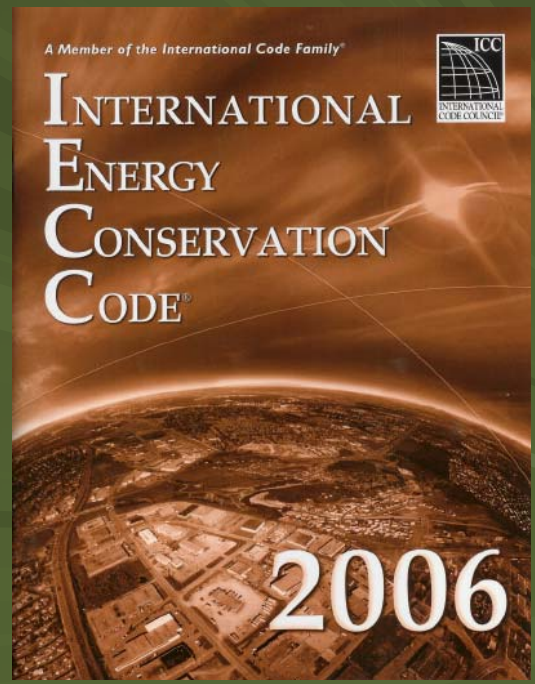


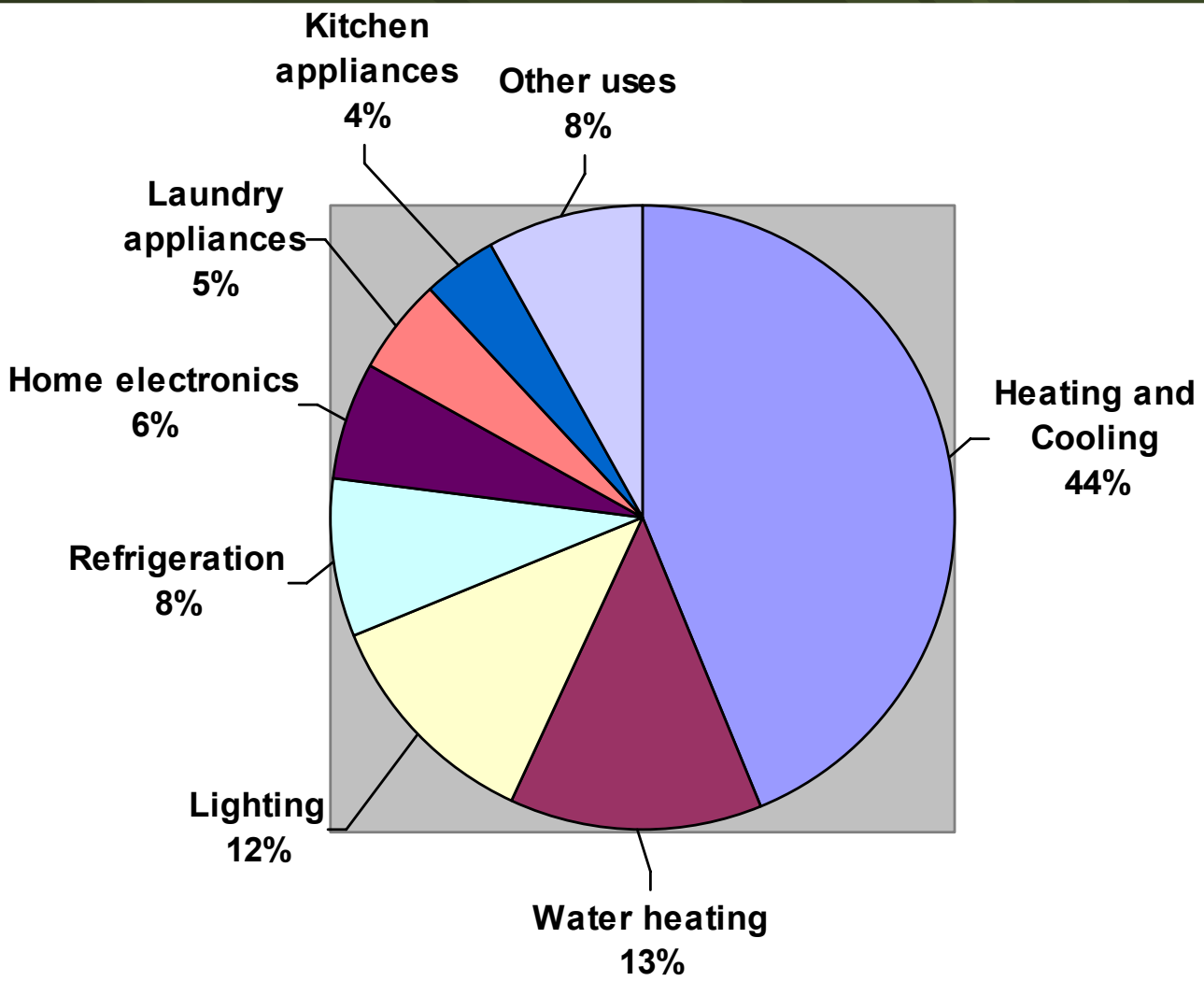
Available From ICC (International Code Council)

- Virginia provisions and amendments to the International Codes are available as combined documents from ICC.
- Visit iccsafe.org to purchase the Virginia versions of all model codes.

ENERGY EFFICIENCY

Chapter 11

Residential energy use



Presentation Topics

- Key Terms
- Building Design and Plan Review
- Construction and Inspection
- New Energy Requirements

Key Terms

Key Term

- **Building Thermal Envelope**: The basement walls, exterior walls, floor, roof and any other building element that enclose conditioned spaces.

Key Term

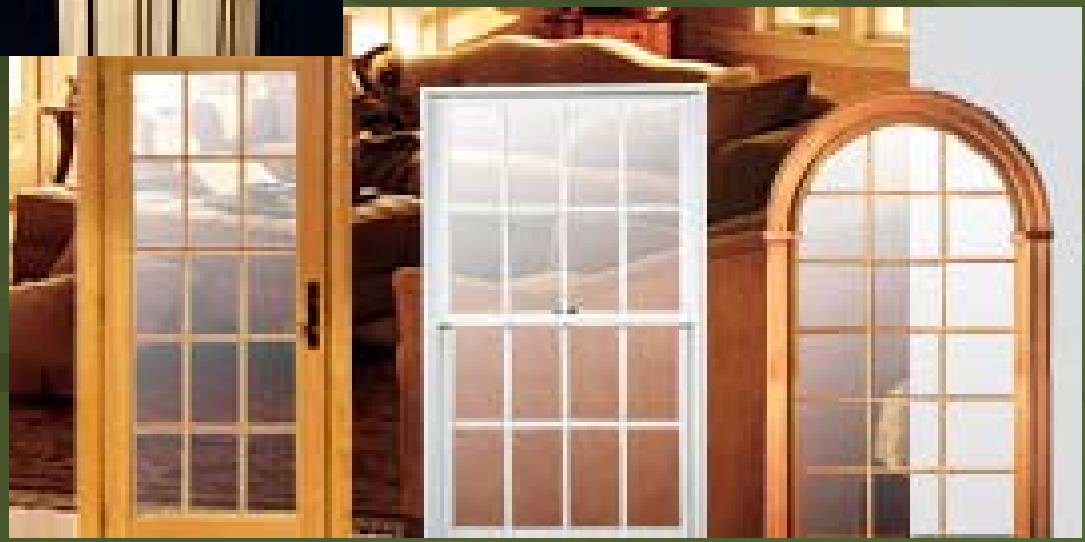
- **Conditioned Space: The space within a building that is provided with heating and cooling equipment capable of maintaining, either through design or heat loss/gain, 50°F during the heating season and 85°F during the cooling season.**

Key Term

- **Draft Stop**: A material or device to restrict the movement of air within open spaces of concealed areas of building components; such as crawl spaces, floor-ceiling assemblies, roof-ceiling assemblies and attics.

Key Term

- Fenestration: Skylights, roof windows, vertical windows (whether fixed or moveable); opaque doors; glazed door; glass block and combination opaque/glazed doors.



Key Term

- **Mass Wall: Masonry or concrete walls having a mass greater than or equal to 30 pounds per square foot; solid wood walls having a mass greater than or equal to 20 pounds per square foot, and any other walls having a heat capacity ≥ 6 Btu/ft^2 X ˚F.**

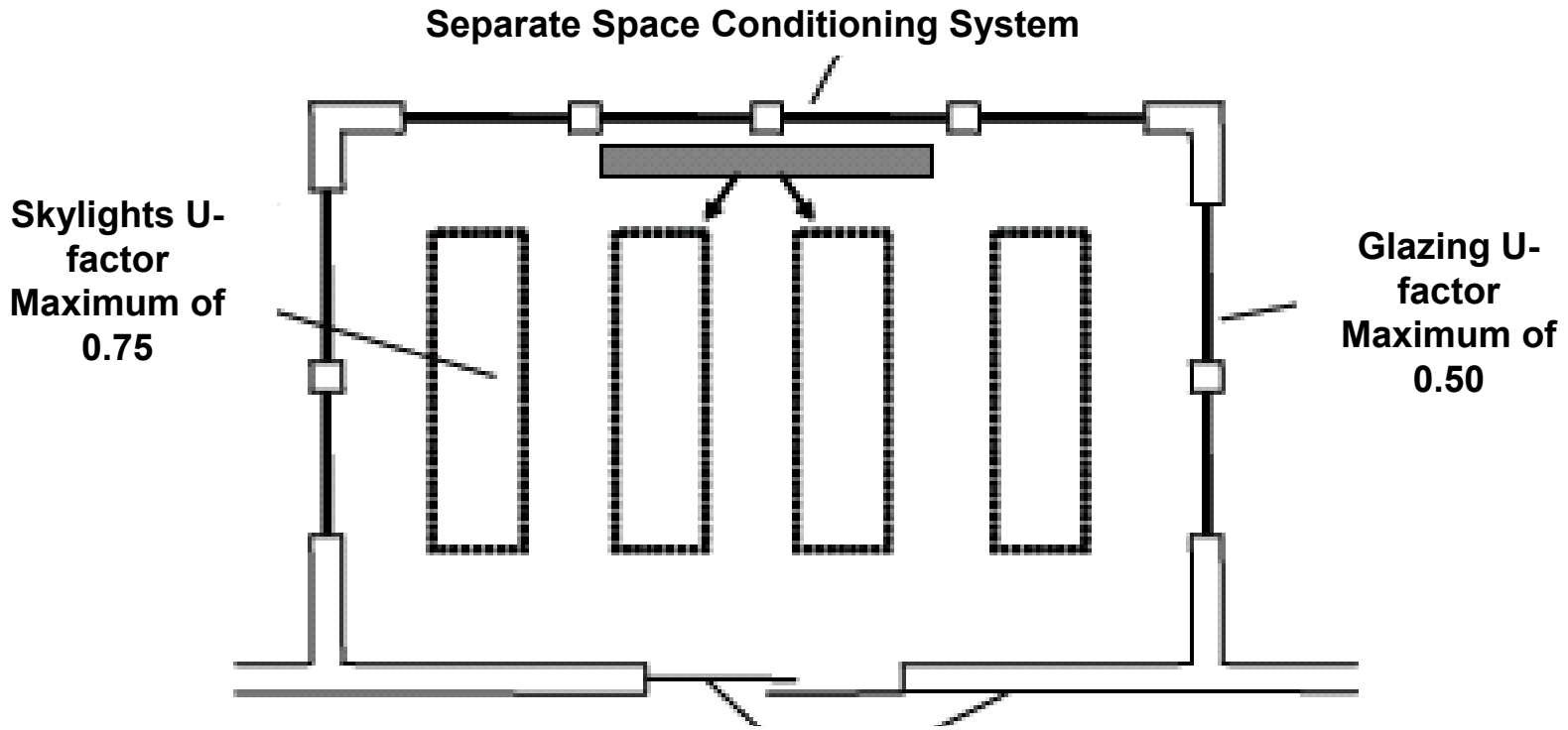

30 WEEP HO

Key Term

- Sunroom: A one story structure attached to a dwelling with a glazing area in excess of 40 percent of the gross area of the structure's exterior walls and roof.

Key Term

- **Thermal Isolation: Physical and space conditioning separation from conditioned space(s). The conditioned space(s) shall be controlled as separate zones for heating and cooling or conditioned by separate equipment (other than that used for the dwelling).**



Example of a Thermally Isolated Sunroom

Note

- Sunrooms are not required to be thermally isolated, but if not, must meet energy conservation requirements for the main structure.

Key Term

- ***R*-Value:** A term used in the building industry to describe insulation properties of certain materials. Their use is limited to situations where thermal insulation is achieved by retarding the flow of heat through the material rather than reflecting radiant heat. **The higher the *R*-Value, the greater the insulation.**

Key Term

- *U*-Factor: Measure of a material's heat-conducting properties, used to compare the efficiency of insulating products. A good insulator has a low *U*-value. The *U*-value of a material is the rate at which heat is conducted through it per unit surface area per unit temperature difference between its two sides. **The lower the *U*-Factor, the greater the insulation.**

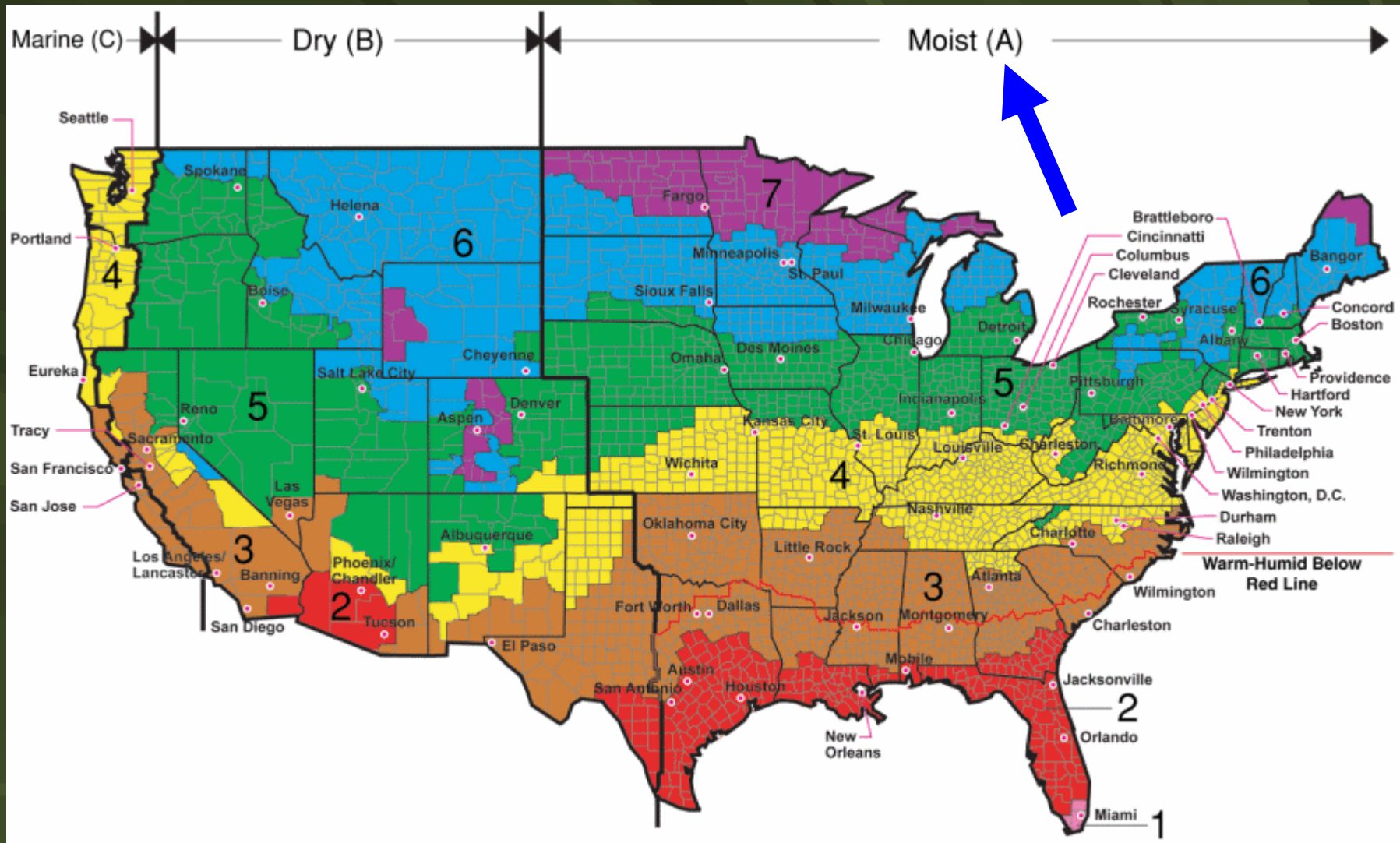
U-Factor = 1÷R-Value

U-.033 ≈ R-30

Building Design and Plan Review

N1101.7: Above Code Programs

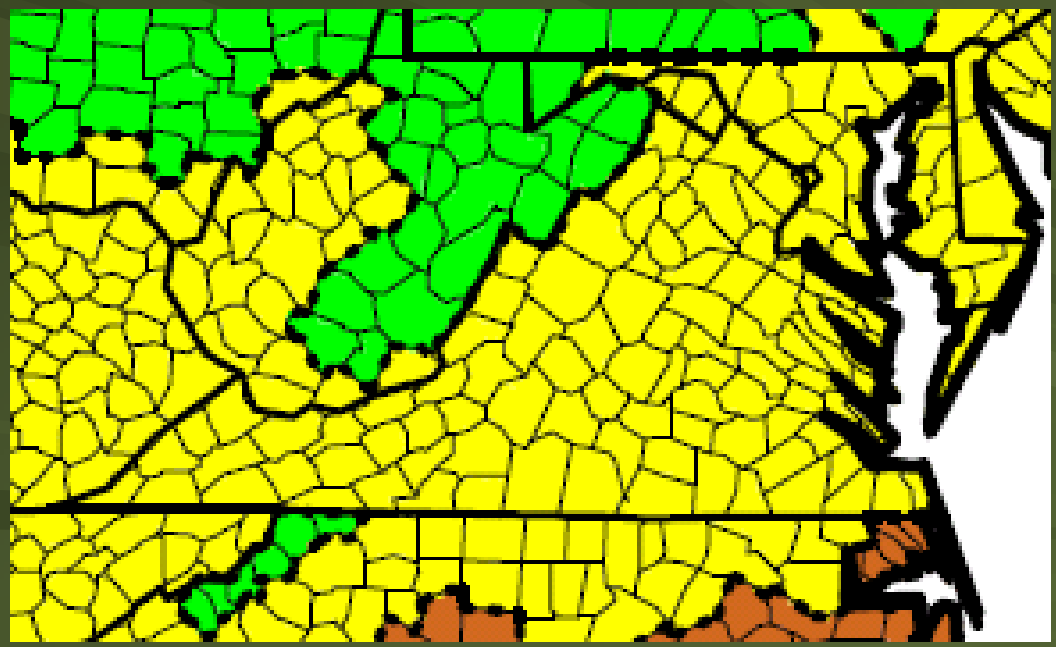
- The Building Official is permitted to approve accredited programs that exceed the requirements of the code, and such programs shall be deemed to satisfy the requirements of the code.



All of Virginia is in Zone 4

Climate Zone

- Virginia is in climate zone 4A



Insulation and Fenestration Requirements

Climate zone	Fenestration U-factor	Skylight U-factor	Glazed Fenestration SHGC	Ceiling R-value	Wood Frame wall R-value	Mass Wall R-value	Floor R-value	Basement Wall R-value	Slab R-value	Crawl Space wall R-value
1	1.2	0.75	0.40	30	13	3	13	0	0	0
2	0.75	0.75	0.40	30	13	4	13	0	0	0
3	0.65	0.65	0.40	30	13	5	19	0	0	5/13
4 except Marine	**0.40**	**0.60**	**NR**	**38**	**13**	**5**	**19**	**10/13**	**10, 2ft**	**10/13**
Marine 4	0.35	0.60	NR	38	13+5	13	30	10/13	10, 4ft	10/13
6	0.35	0.60	NR	49	19 or 13+5	15	30	10/13	10, 4ft	10/13
7and 8	0.35	0.60	NR	49	21	19	30	10/13	10,4ft	10/13

IRC Table N1102.1

Thermal Envelope Requirements

Walls (R-value)	13
Floors (R-value)	19
Ceiling (R-value)	38
Basement Walls (R-value)	10[1]/ 13[2]
Crawl Space Walls (R-value)	10[1] /13[2]
Slab (R-value)	10, 2ft
Mass Wall (R-value)	5
Windows (U-factor)	0.40
Skylights (U-factor)	0.60
Doors (U-factor)	0.40

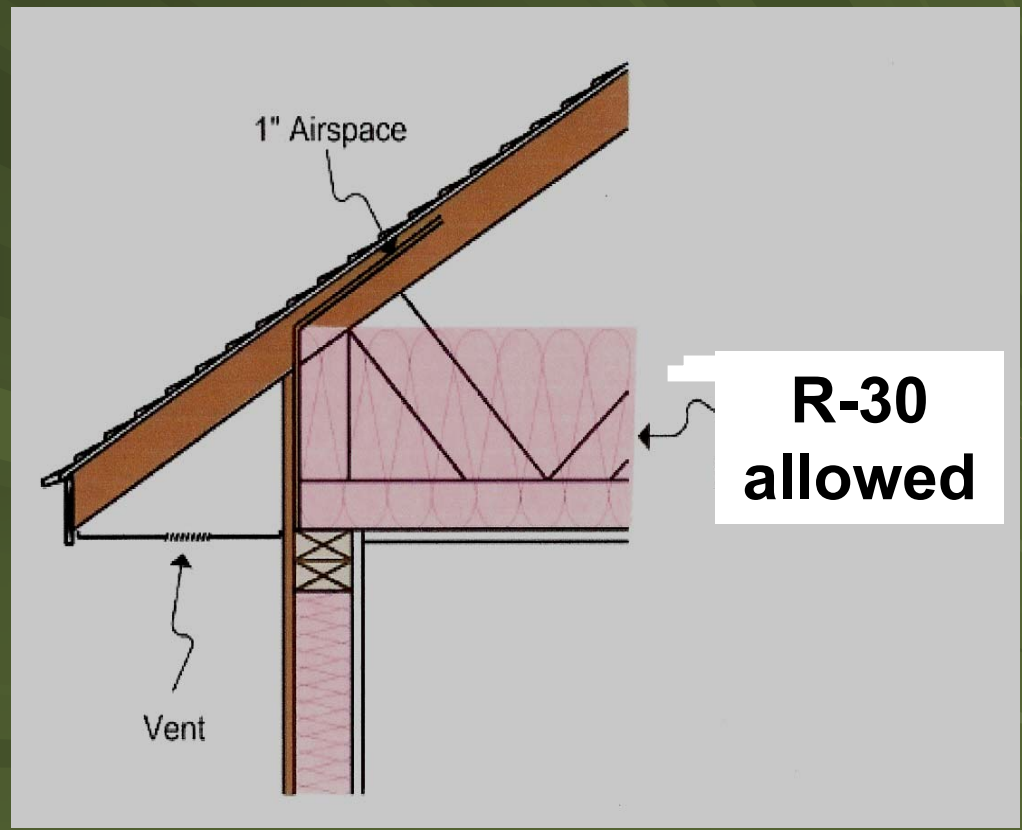
1= Continuous insulation 2= Framing cavity insulation

Thickness of Insulation

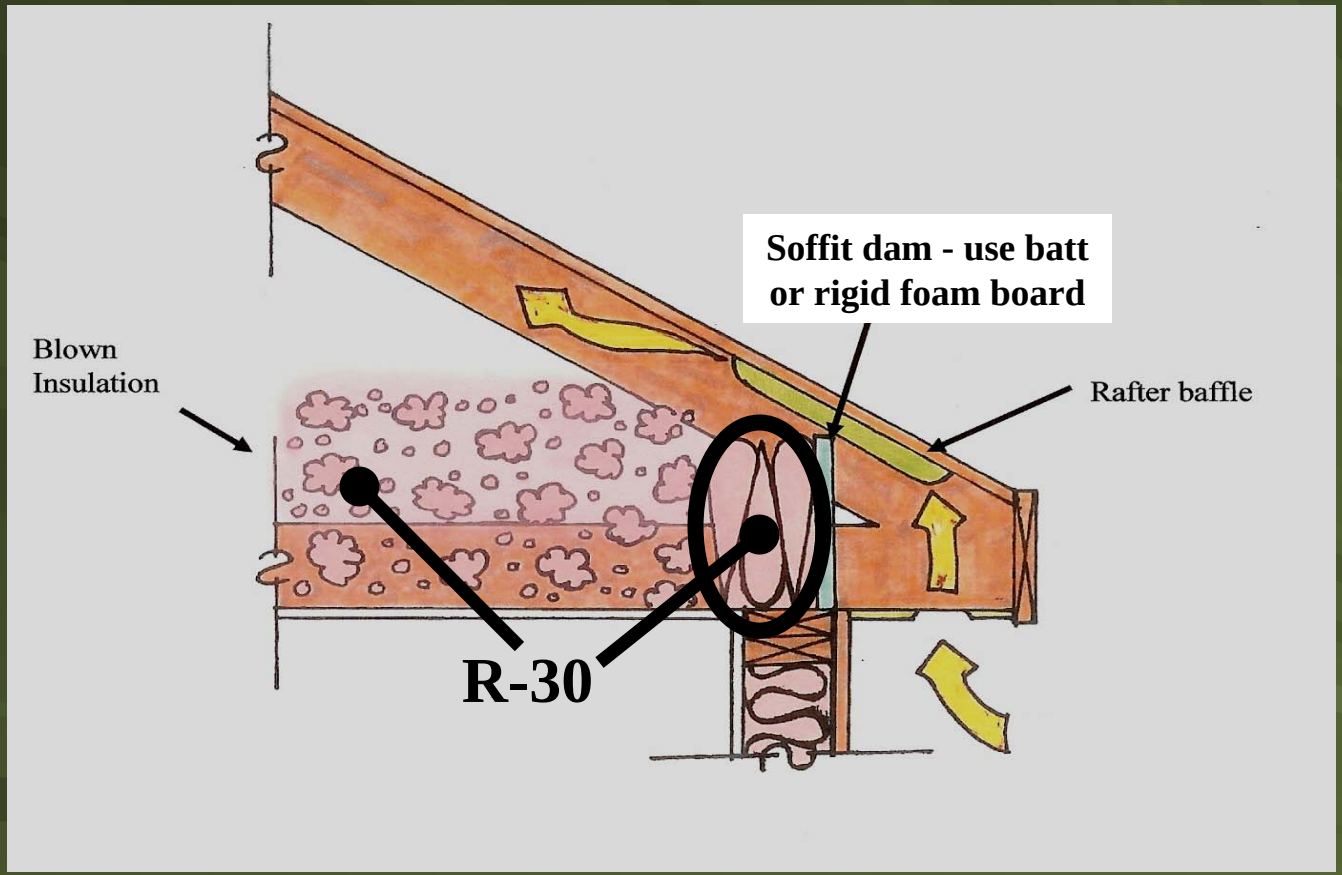
- *R*-38 – 12”
- R-38c – 10 ¼”
- *R*-30 – 9 ½”
- *R*-30c – 8 ¼”
- *R*-19 – 6 ¼”
- *R*-13 – 3 ½”
- *R*-10 – 2” of rigid foam

N1102.2.1: Exception for R-38 in attics – high heeled truss

- *R*-30 insulation is deemed to satisfy the requirement for *R*-38 insulation whenever the full height of uncompressed *R*-30 insulation extends over the wall top plate at the eaves

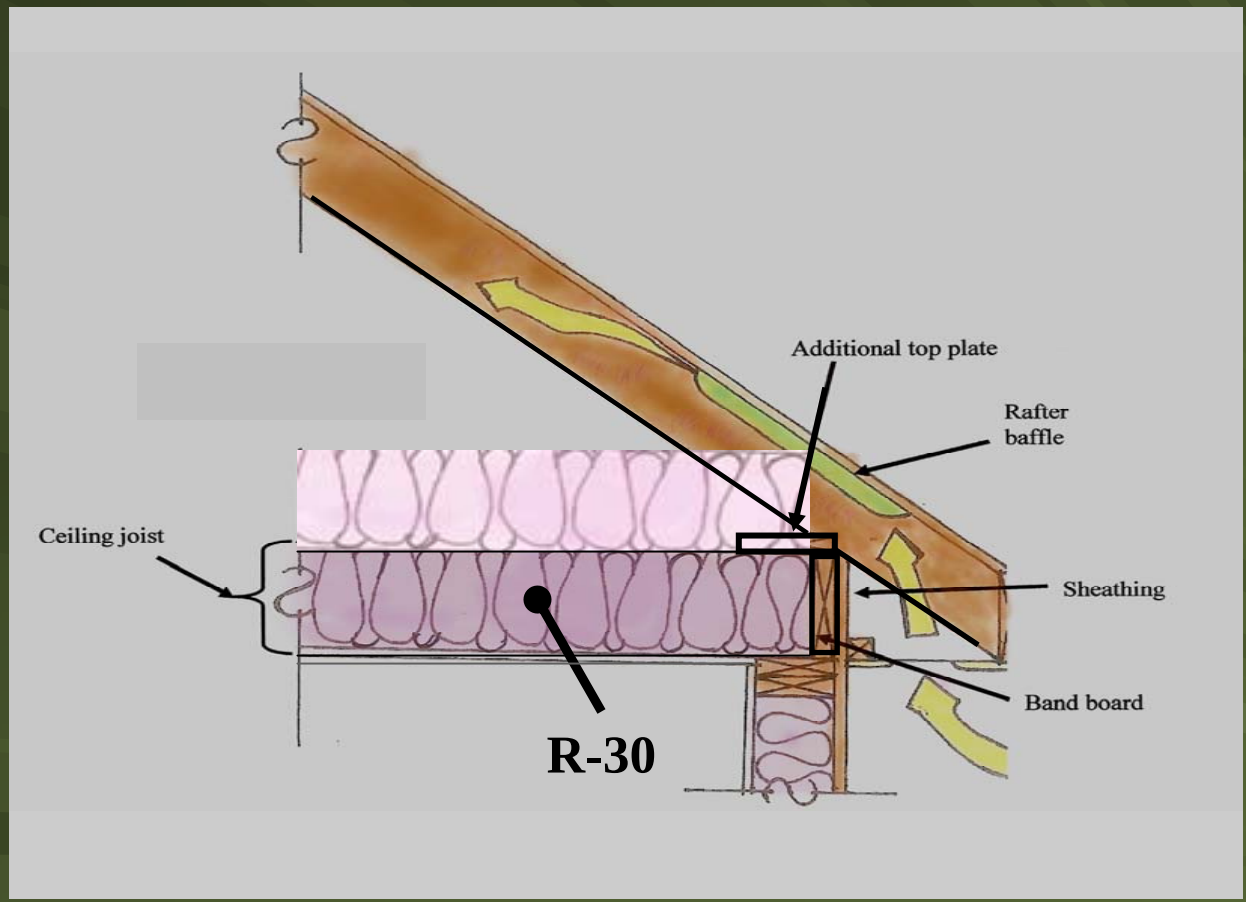


N1102.2.1: Exception for R-38 when standard truss roof is used



***R*-30 insulation must extend over the wall top plate**

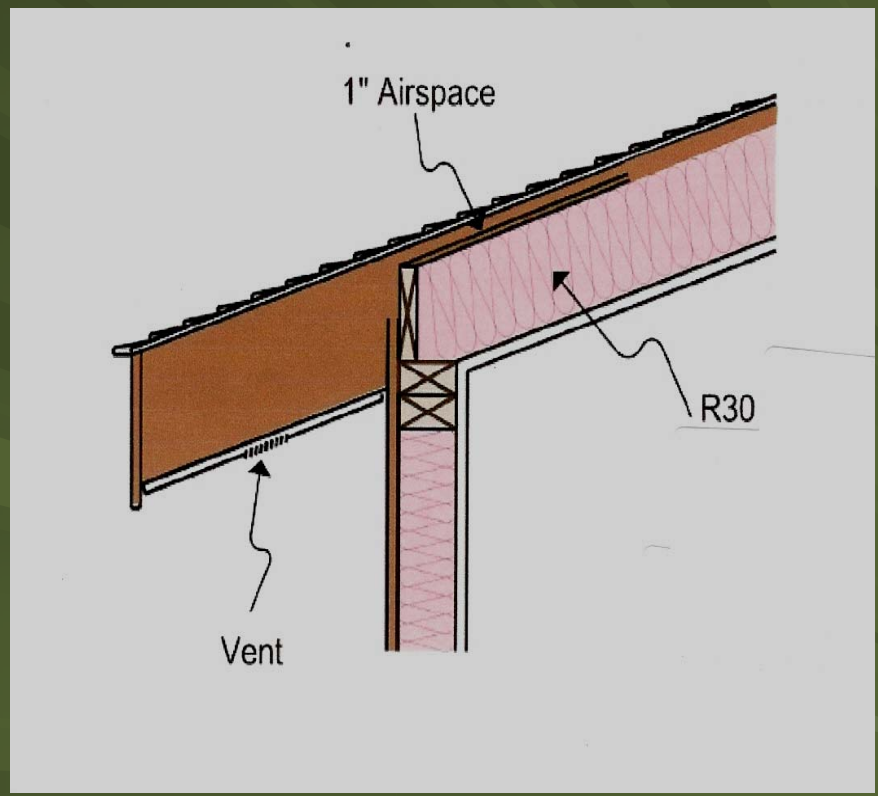
N1102.2.1: Exception for R-38 in attics of conventional framing



***R*-30 insulation must extend over wall top plate**

N1102.2.2: Exception for R-38 in cathedral ceilings

- *R*-30 insulation can be used in a roof ceiling assembly that does not allow sufficient space for *R*-38. <u>This must be identified on plans.</u>



Note: Maximum ceiling area allowed is 500ft^2

Energy Performance of windows and doors

- Windows, skylights and sliding glass doors shall have an air infiltration rate of maximum 0.3 cubic ft./min./per sq. ft.
- Swinging doors shall have an air infiltration rate of no more than 0.5 cubic ft./min./per sq. ft.

Energy Performance of windows

A measure of the rate of heat loss by the window (including glass and frame).

A measure of how much of the sun's heat will pass through the glass.

A measure of the percent of light that comes through the window.

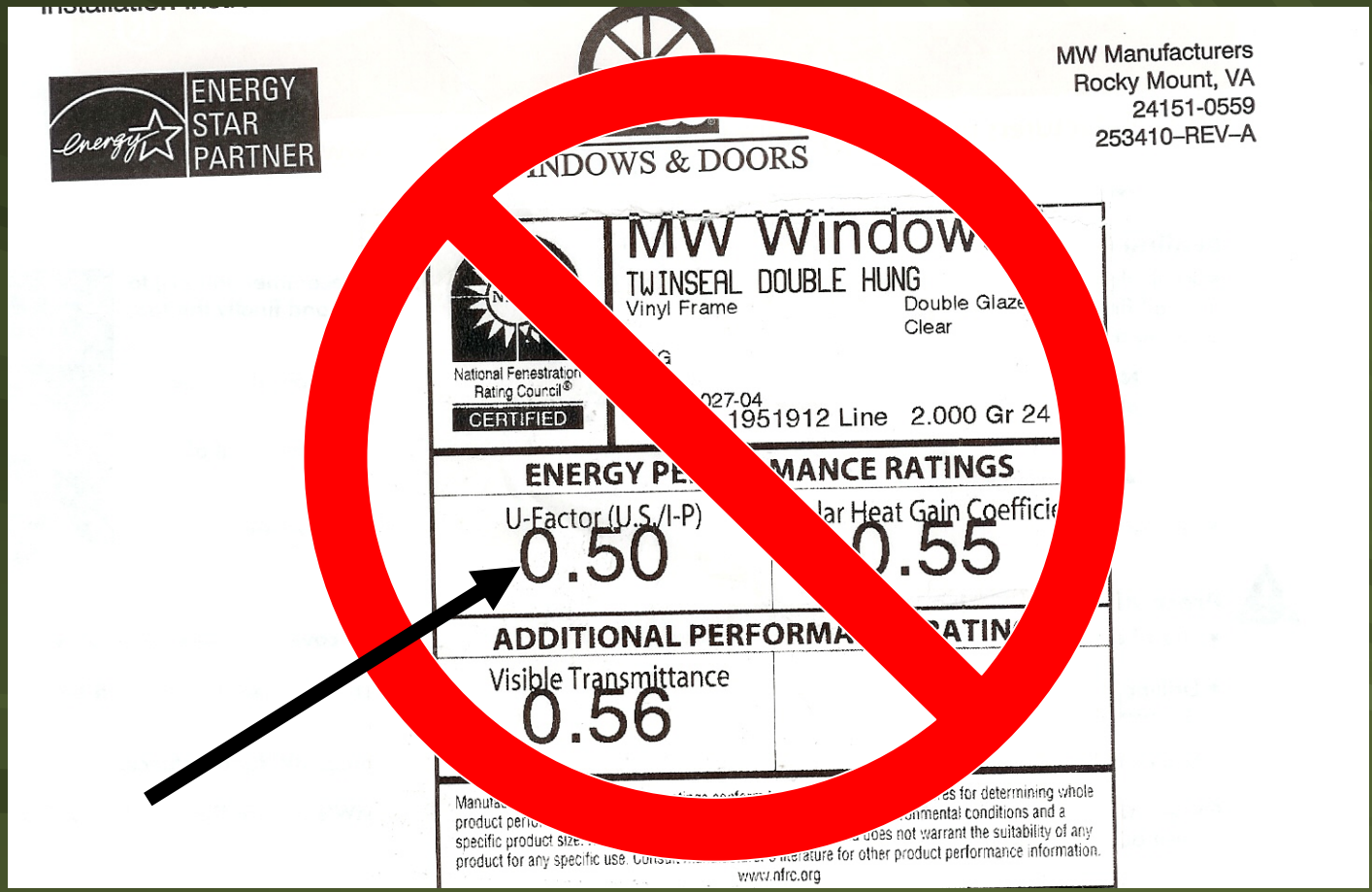
A measure of the rate at which air leaks through cracks in the window assembly.

N1102.3.3: Glazed fenestration exemption

- All fenestration must meet *U*-factor requirement of 0.40 or less.

Exception: Up to 15 ft^2 of glazed fenestration per dwelling is permitted to be exempted from the *U*-factor requirement.

Window *U*-Factor



Door *U*-Factor

Northern Climate Zone (Mostly Heating)	5,400+ HDD	U-Factor 0.35 SHGC Any
North/Central Climate Zone (Heating & Cooling)	3600-5400 HDD	U-Factor 0.40 SHGC 0.55
South/Central Climate Zone (Heating & Cooling)	6300-4500 CDD	U-Factor 0.40 SHGC 0.40
Southern Climate Zone (Mostly Cooling)	>6300 CDD	U-Factor 0.65 SHGC 0.40
Alternative Criteria Allowed		

ENERGY STAR

CONFIRM U-FACTOR & SHGC BELOW TO DETERMINE DOOR MODEL QUALIFICATIONS

NFRC

National Fenestration Rating Council ®

CERTIFIED

Stock Building Supply
Portrait Doors

Inswing or Outswing Door
CPD # SBS-M-5
Fiberglass Door
With/Without 1/2" Glass Insert

ENERGY PERFORMANCE RATINGS

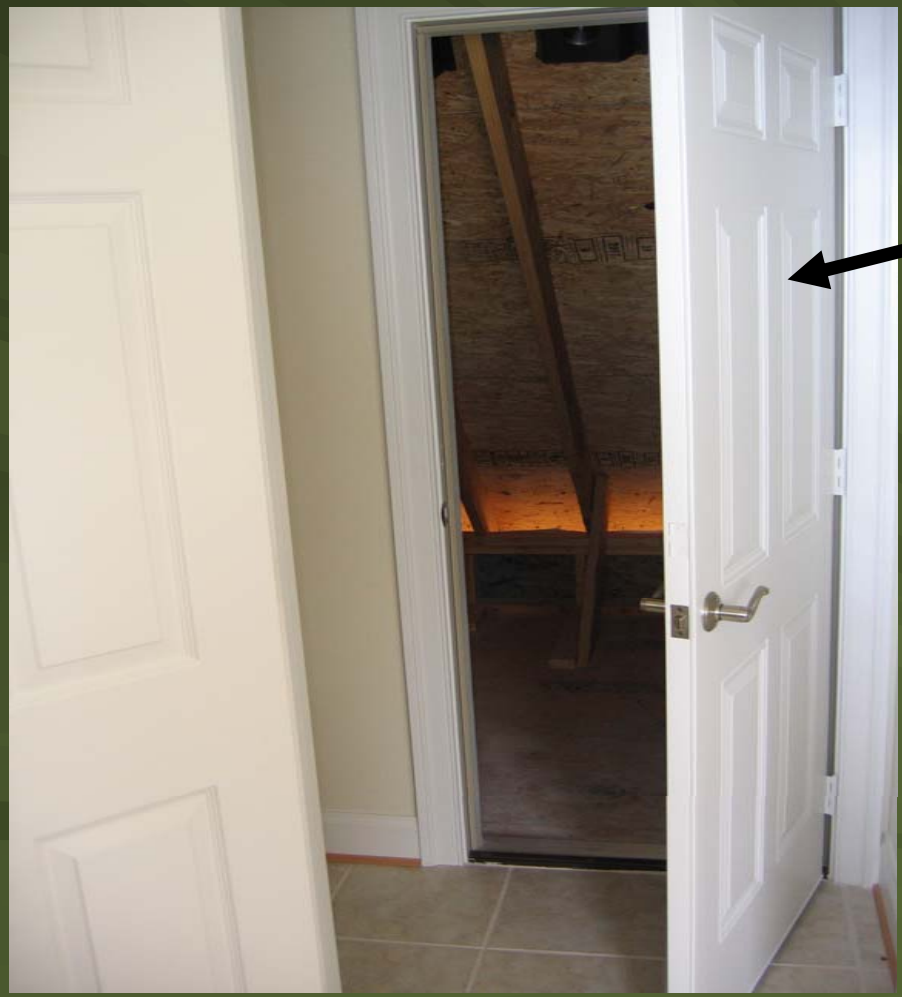
PRODUCT DESCRIPTION* Default Frame** Wood	U-Factor/Solar Heat Gain Coefficient (SHGC)			
	1/4 Lite ≤410†	1/2 Lite ≤ 900†	3/4 Lite ≤1100†	Full Lite > 1100†
IG/Clear/Air/0.25"	0.22 / 0.03	0.28 / 0.14	0.33 / 0.21	0.36 / 0.26
IG/Clear/Air/0.25" W/Grid	0.22 / 0.03	0.28 / 0.13	0.33 / 0.19	0.36 / 0.24
Flush/Embossed	U-Factor **0.19** SHGC **0.01**			

Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size.

*Glazing type/Clear or Coated (surface) / gapfill / gap
**per NFRC 100 Section 3.3 † square inches

DO NOT REMOVE UNTIL AFTER FINAL INSPECTION

Doors to Unconditioned Attics and Basements



N1102.3.4: Opaque door exemption

- Door assemblies must meet the *U*-factor requirement of .40 or less.

Exception: One opaque door assembly is exempted from the *U*-factor requirement.

Doors to Unconditioned Attics and Basements

One opaque door assembly is exempted from the *U*-factor requirement.

Exterior Door

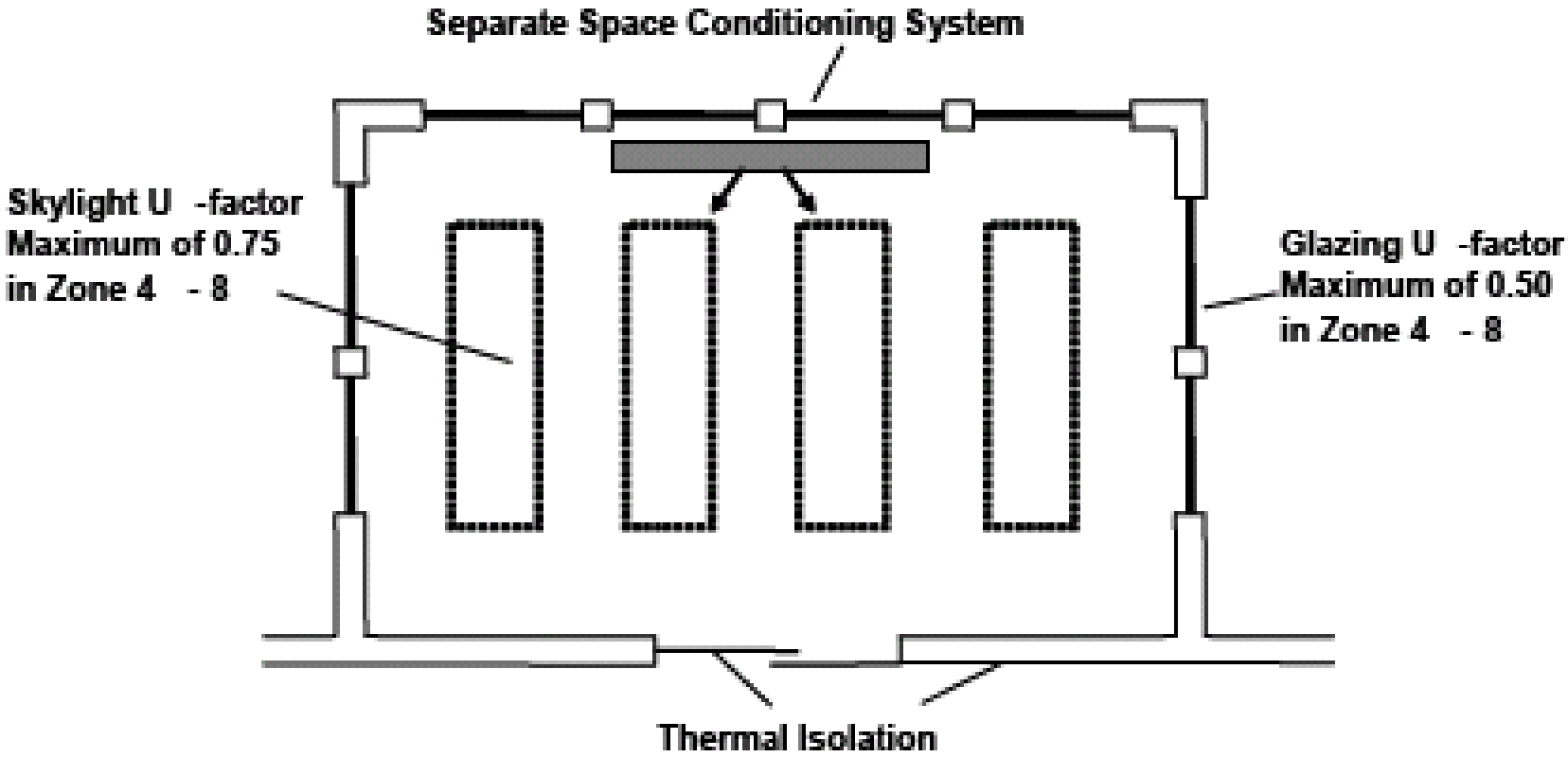
Sunroom vs. Addition

- Any one story structure attached to a dwelling with glazing in excess of **40%** of the gross area of the walls and roof is a sunroom. These rooms must be **thermally isolated** from the dwelling to take advantage of the increased glazing U-value and reduce ceiling R-value allowed for a sunroom.
- All other structures are additions.

N1102.2.10: Thermally Isolated Sunroom

- Ceiling/Floor: *R*-19
- Windows: U-.5
- Skylights: U-.75
- Walls: *R*-13
- Any new wall(s) separating the sunroom from conditioned space must meet the building thermal envelope requirements
- A zoned or separate HVAC unit must be utilized

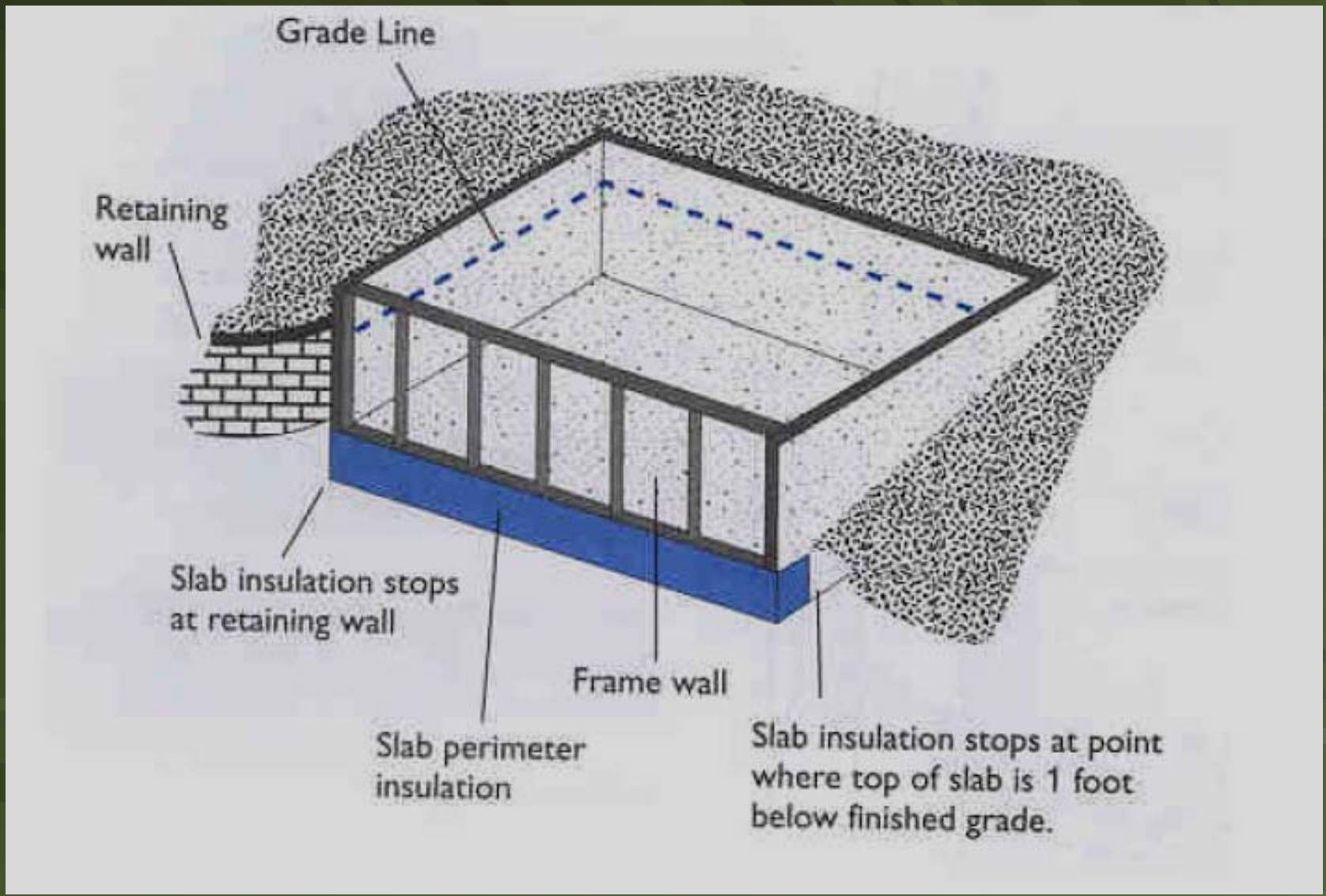
Note: The door to the dwelling shall not be removed.


Separate Space Conditioning System
Skylight U -factor
Maximum of 0.75
in Zone 4 - 8
Glazing U -factor
Maximum of 0.50
in Zone 4 - 8
Thermal Isolation

N1102.2.7: Floor Slab

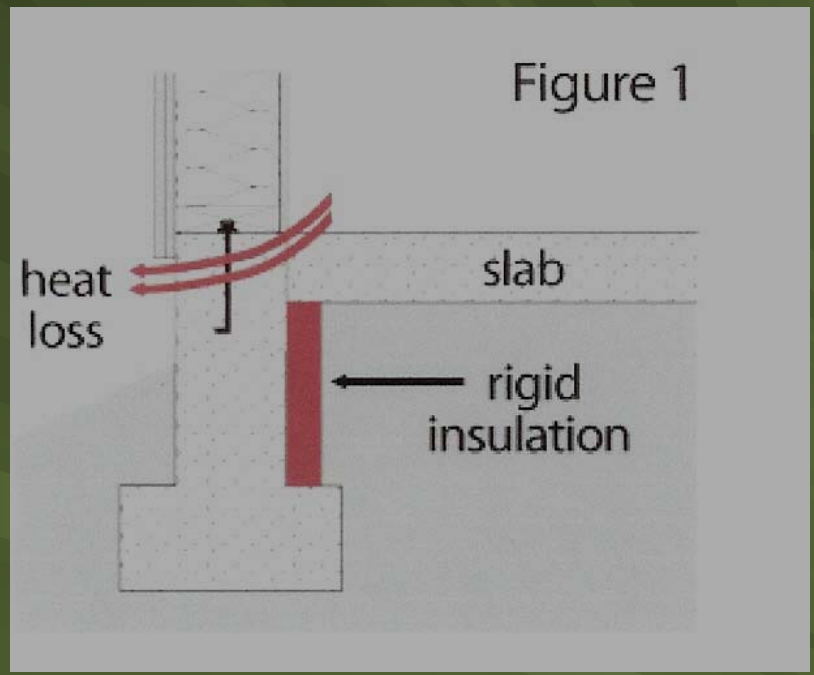
- Any slab-on-grade for conditioned space less than 12” below grade, must have perimeter insulation
- Insulation must extend downward on the inside or outside of the foundation wall, or
- The insulation can be located under the slab
- Must be *R*-10 extending 2’

Floor Slab


Grade Line
Retaining wall
Slab insulation stops at retaining wall
Frame wall
Slab perimeter insulation
Slab insulation stops at point where top of slab is 1 foot below finished grade.

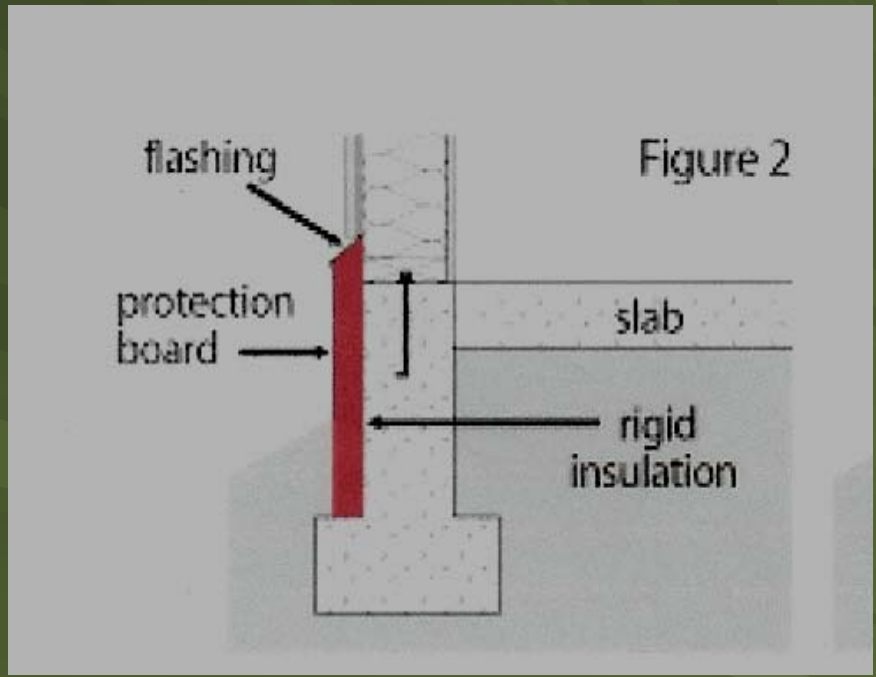
Floor Slab

- **A substantial amount of heat is lost through an uninsulated slab.**



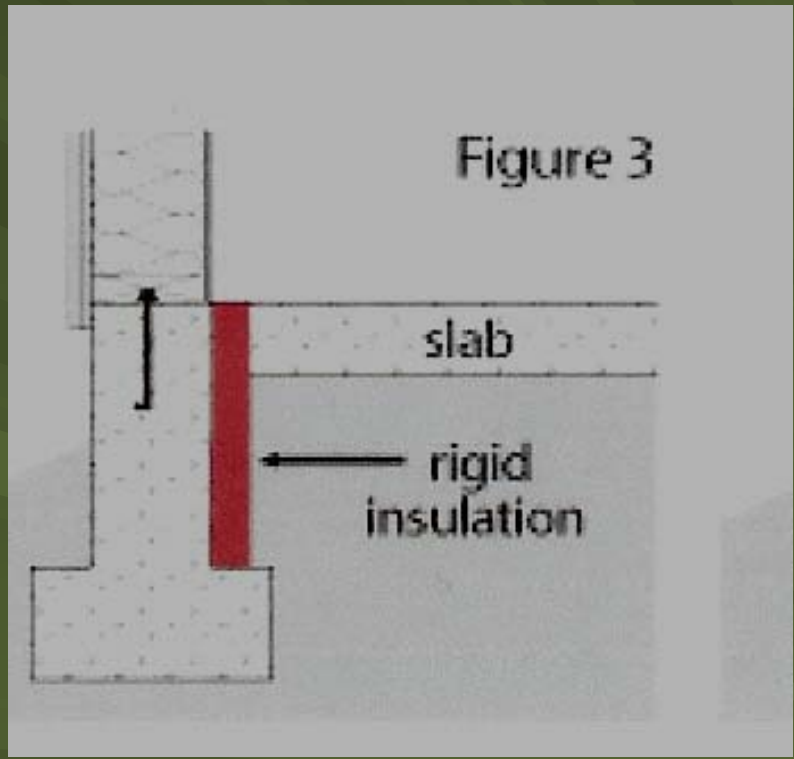
Floor Slab

- **Insulation can be applied to outside of the foundation, provided that it is protected from the environment.**



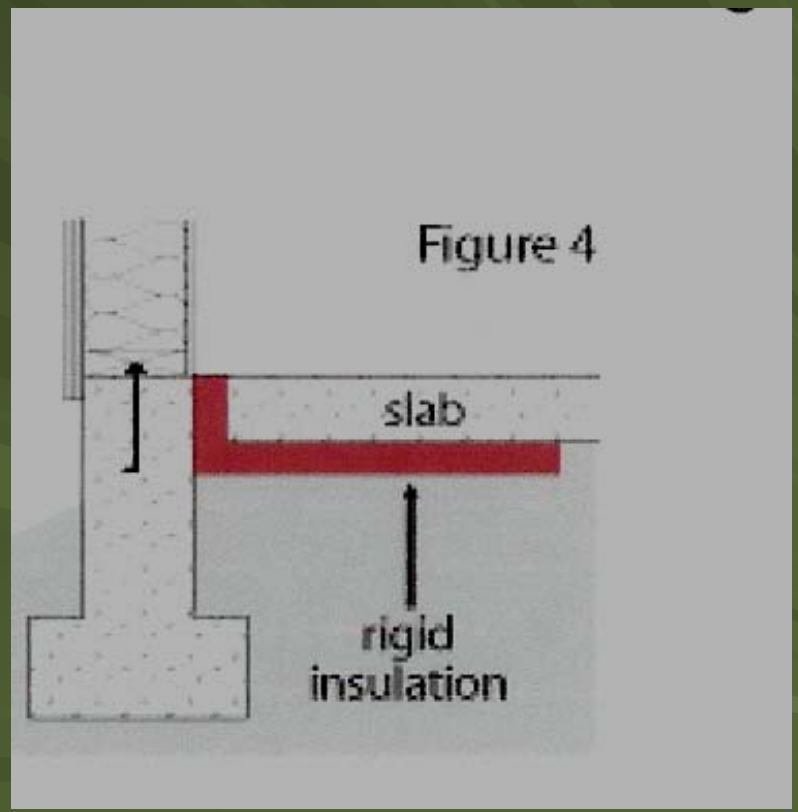
Floor Slab

- **Insulation can be applied to inside of the foundation**



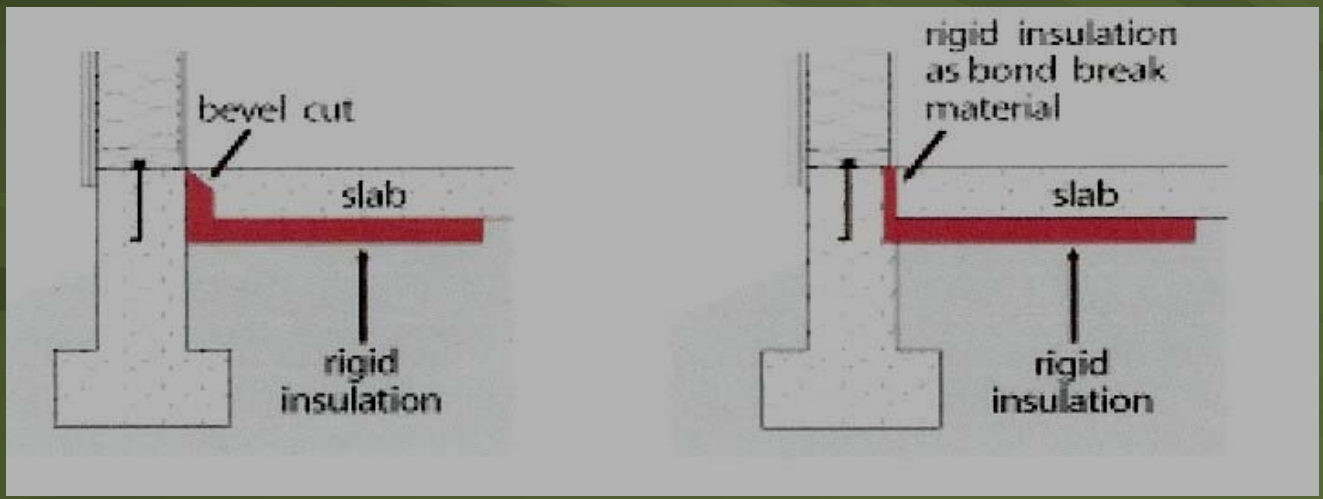
Floor Slab

- **Insulation can be applied vertically along the inside of the foundation to the depth of the slab and then horizontally under the slab.**



Floor Slab

- **The insulation can be cut at a 45° bevel or bond break material can be installed so a carpet tack strip can be installed**



N1102.2.8: Conditioned Crawl Space

- Crawl space walls must be insulated from the bottom of floor to the finished grade and then vertically and /or horizontally 24”
- *R*-10 with continuous insulation
- *R*-13 with framing cavity

Construction and Inspections

R408.3 and N1102.2.8: Non-vented and Conditioned Crawl Spaces

- **Exposed earth is covered with a continuous vapor retarder.**
- **All joints of the vapor retarder shall overlap by 6” and be sealed or taped.**
- **The edges of the vapor retarder shall extend at least 6” up the stem wall and shall be attached to the stem wall.**

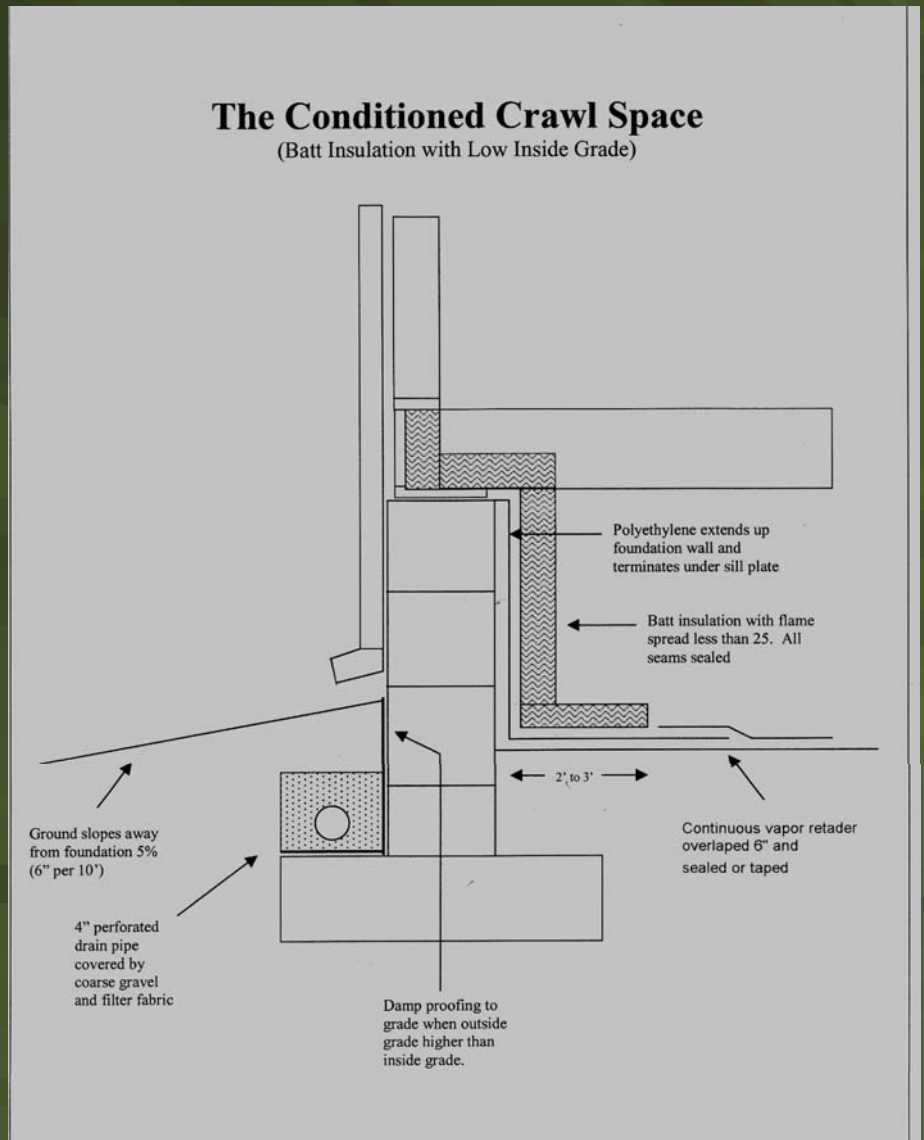
R314.3: Foam Plastic in Crawl Spaces and Attics

- All foam plastic shall have a flame spread index of ≤ 75 and a smoke development index of ≤ 450

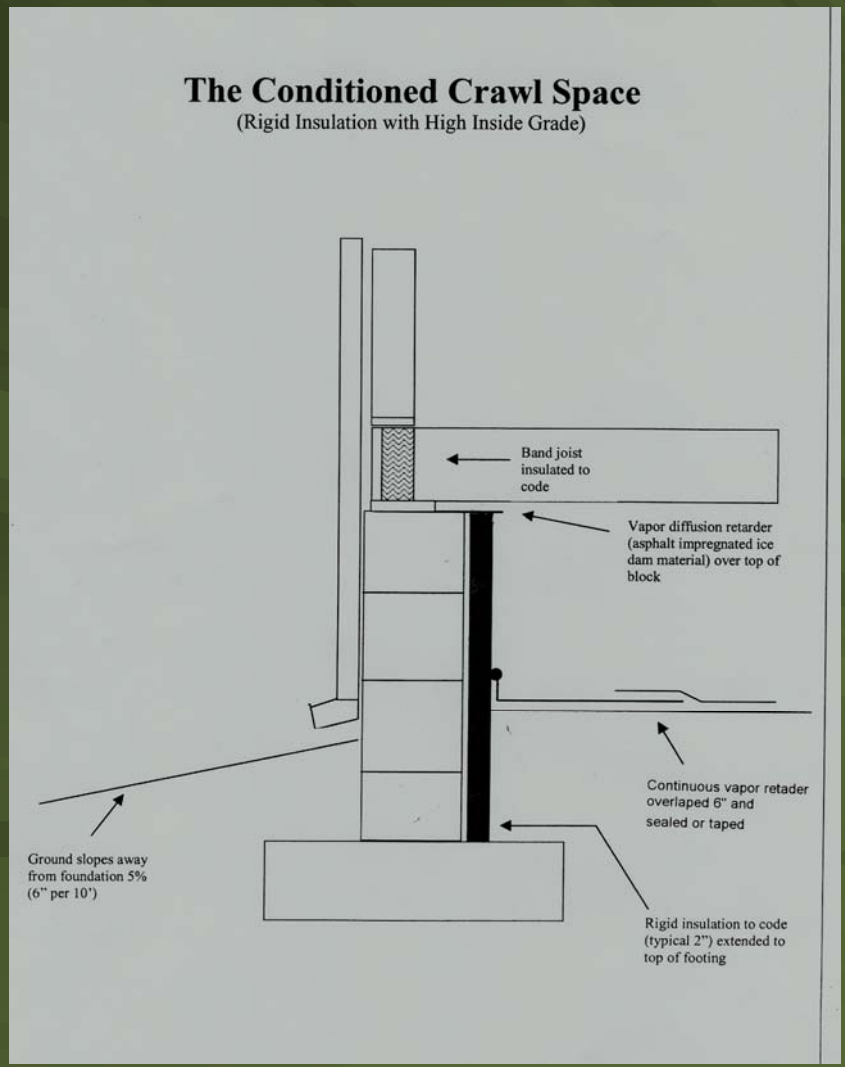
R314.3: Foam Plastic in Crawl Spaces and Attics

- Foam plastic must be protected against ignition by one of the following barriers:
  - 1.5” mineral fiber insulation
  - 0.25” wood structural panels
  - 0.375” particleboard
  - 0.25” hardboard
  - 0.375” gypsum board
  - 0.016”Corrosion resistant steel

Example of insulated crawl space



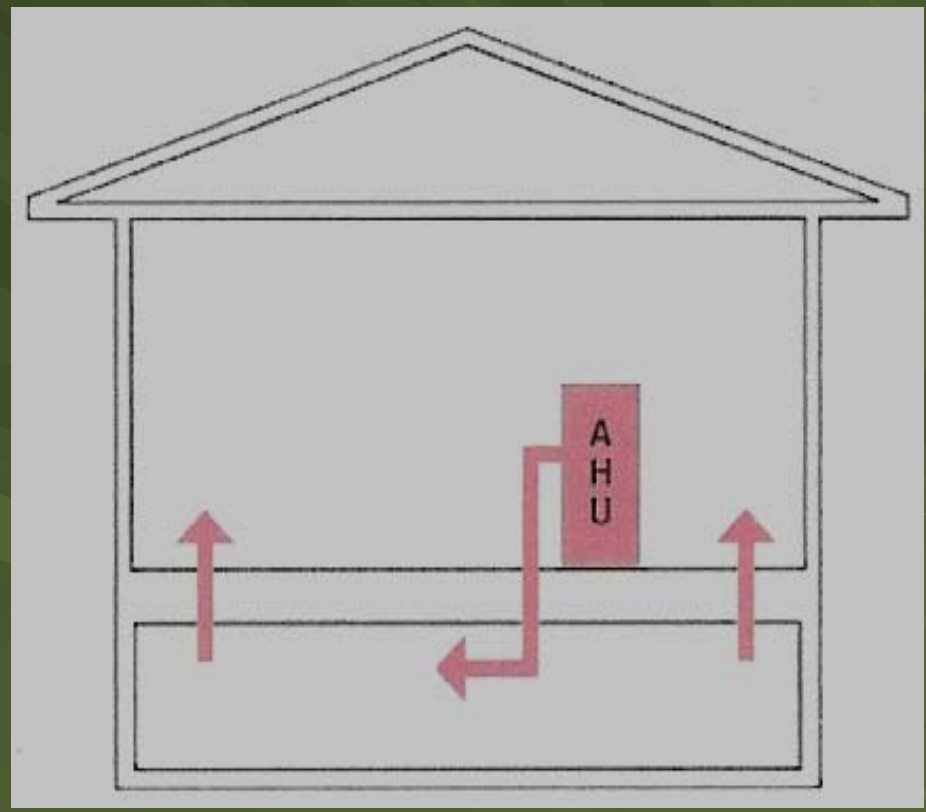
Example of insulated crawl space



Insulated Crawl Space

R408.3: Conditioned Crawl Space

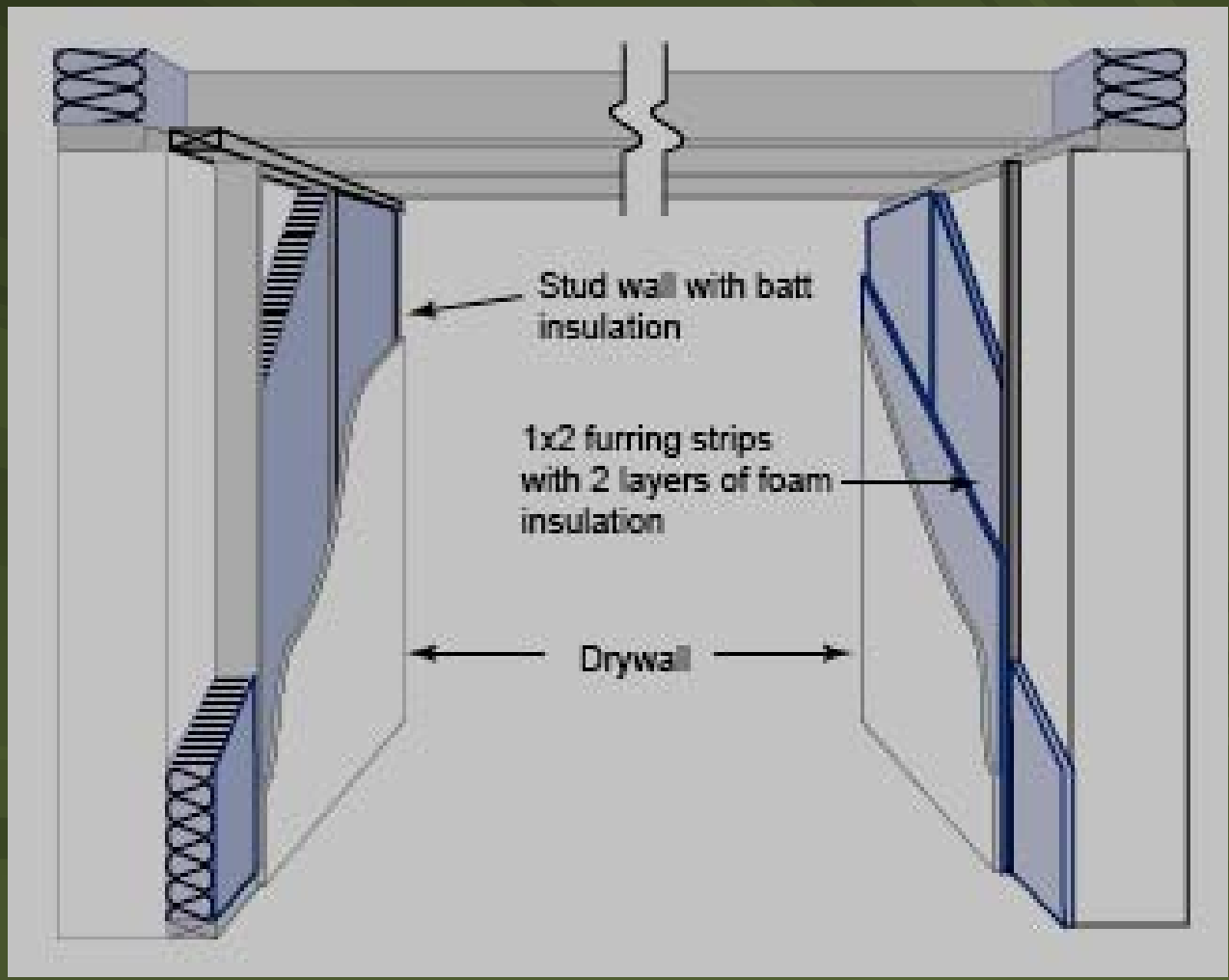
- Conditioned air supplied to crawl space
- 1 CFM of flow per 50 sq. ft.
- Air flows back to house thru ducts or transfer grille



N1102.2.6: Conditioned Basements

- Exterior walls must be insulated from the top of the wall to a minimum 10’ below grade or to the basement floor whichever comes first
- *R*-10 with continuous insulation
- *R*-13 with framing cavity

Conditioned Basement



Conditioned Basement

Conditioned Basement

R806.4: Un-vented Attic

- Conditioned space completely contained within the building envelope
- No interior vapor retarders are installed on the ceiling between the finished room and the attic
- ¼” air space between wood shingles / shakes and the roofing decking

R806.4: Un-vented Attic

- One of the following three insulation methods must be met:

- Air-impermeable insulation only: must be applied directly to the underside of the roof deck

R806.4: Un-vented Attic Cont'd

- Air-permeable insulation only: must be applied directly below the structural sheathing. *R*-15 rigid board or sheet insulation shall be installed directly above the structural roof sheathing for condensation control. Total *R*-value must be *R*-38 or greater.

Un-vented Attic

R806.4: Un-vented Attic Cont'd

- **Air-impermeable and permeable insulation: R-15 air impermeable insulation must be applied directly to the underside of the roof deck for condensation control and air-permeable insulation must be installed directly under the air impermeable insulation. The combined insulation value must be at least *R*-38.**

Un-vented Attic

Verify requirement for ignition barrier

Insulate gable walls

N1102.4.1: Building Thermal Envelope Air Leakage

- **Building envelope shall be durably sealed to limit infiltration**
- **Sealant materials must allow for differential expansion and contraction between dissimilar materials**

N1102.4.1: Building Thermal Envelope Air Leakage

- **The following must be caulked, gasketed, weather-stripped or otherwise sealed with an air barrier material (such as 15lb. felt or Tyvek), suitable film (such as Sill Seal) or solid material:**

N1102.4: Air Leakage Locations

- Joints, seams and penetrations
- Site built windows, doors and skylights
- Openings between window and door assemblies and their jambs and framing
- Utility penetrations
- Dropped ceiling or chases adjacent to the thermal envelope
- Knee walls

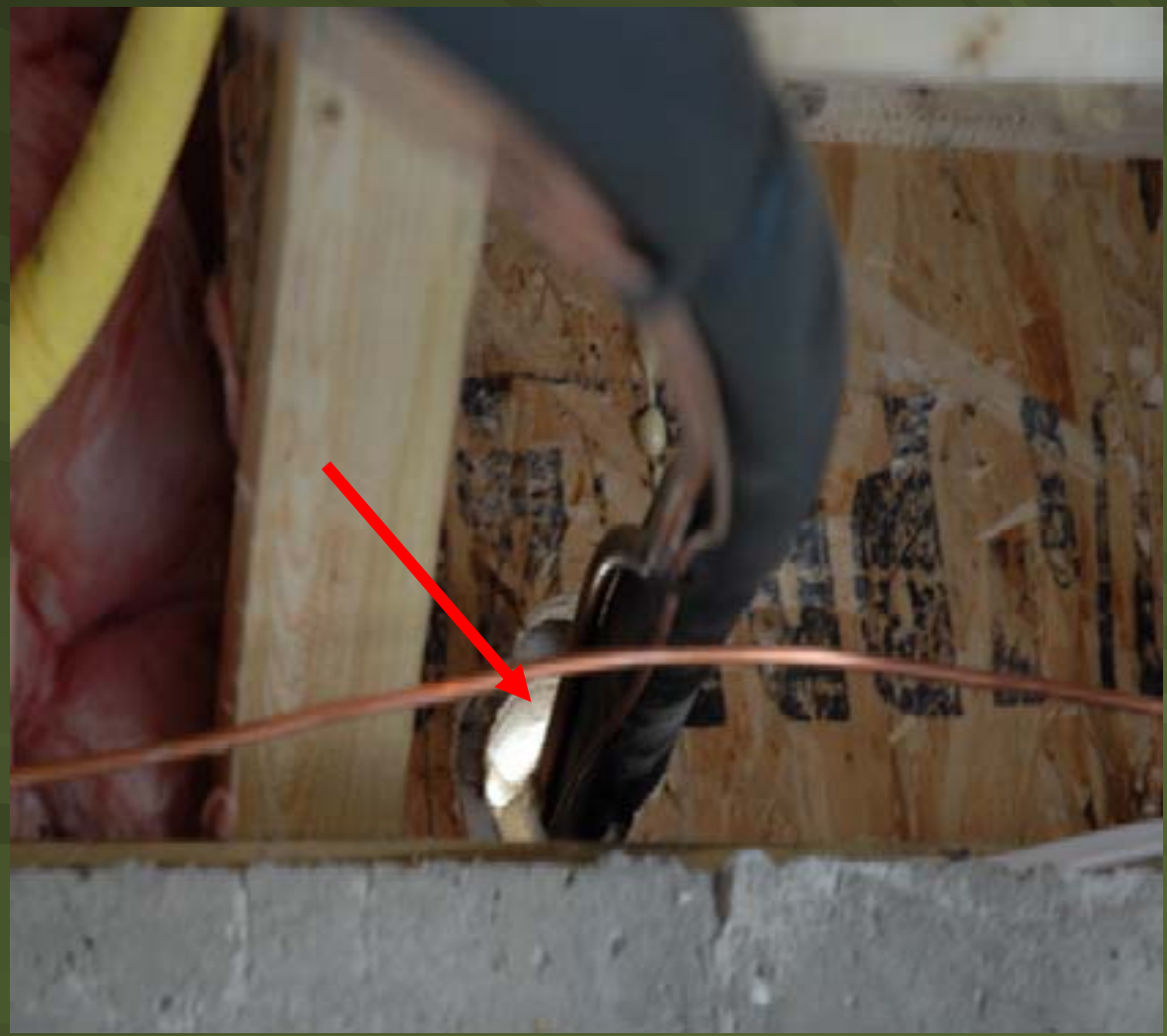
N1102.4: Air Leakage Locations Cont'd

- **Walls and ceilings separating the garage from conditioned spaces**
- **Behind tubs / showers on exterior walls**
- **Common walls between dwelling units**
- **Other sources of infiltration**

Joints, seams and penetrations

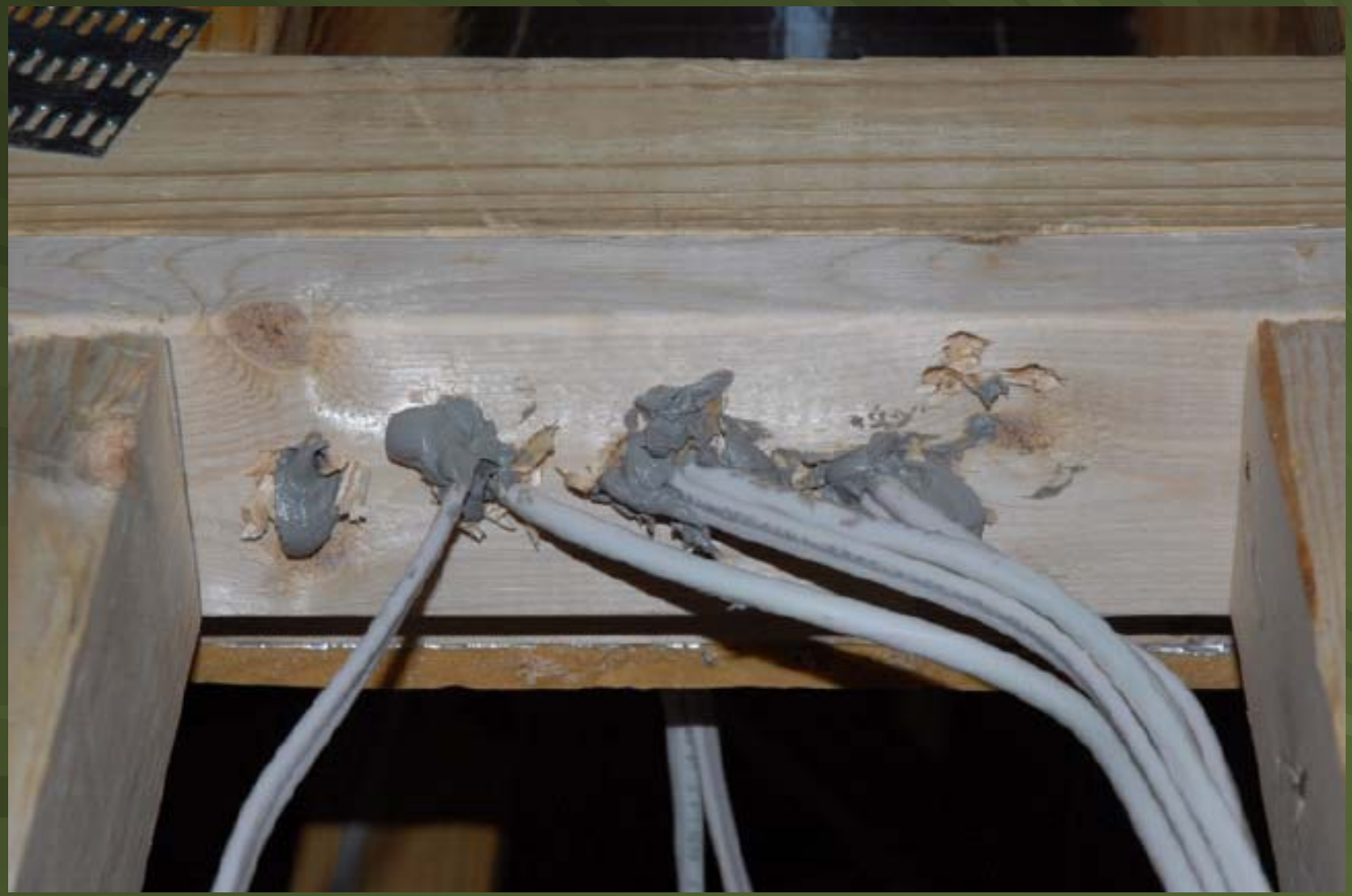
Between windows and jambs

Utility Penetrations



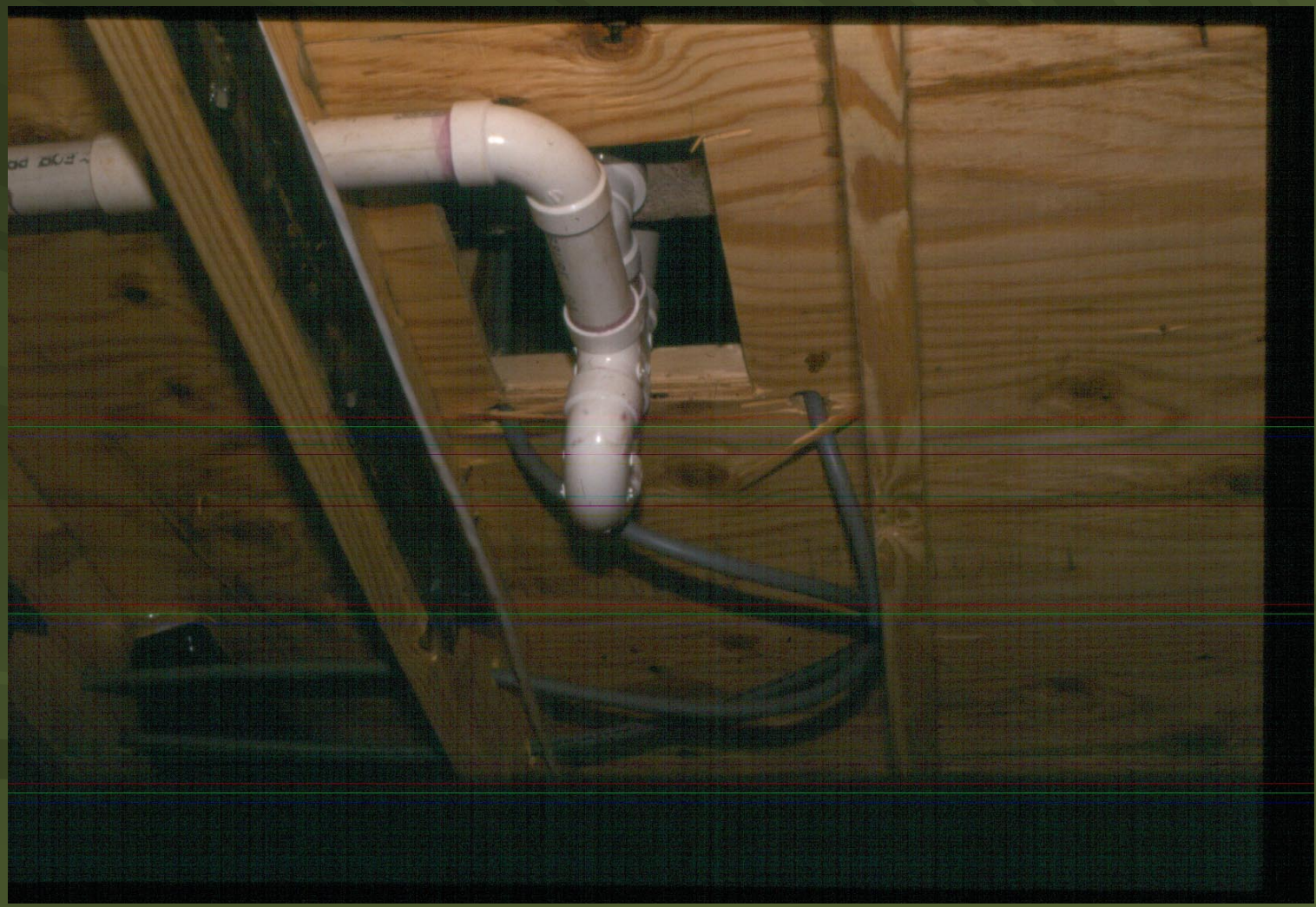
Utility Penetrations

Utility Penetrations



Utility Penetrations – Top and Bottom – Every Level

Utility Penetrations



Utility Penetrations

Utility Penetrations

Utility Penetrations

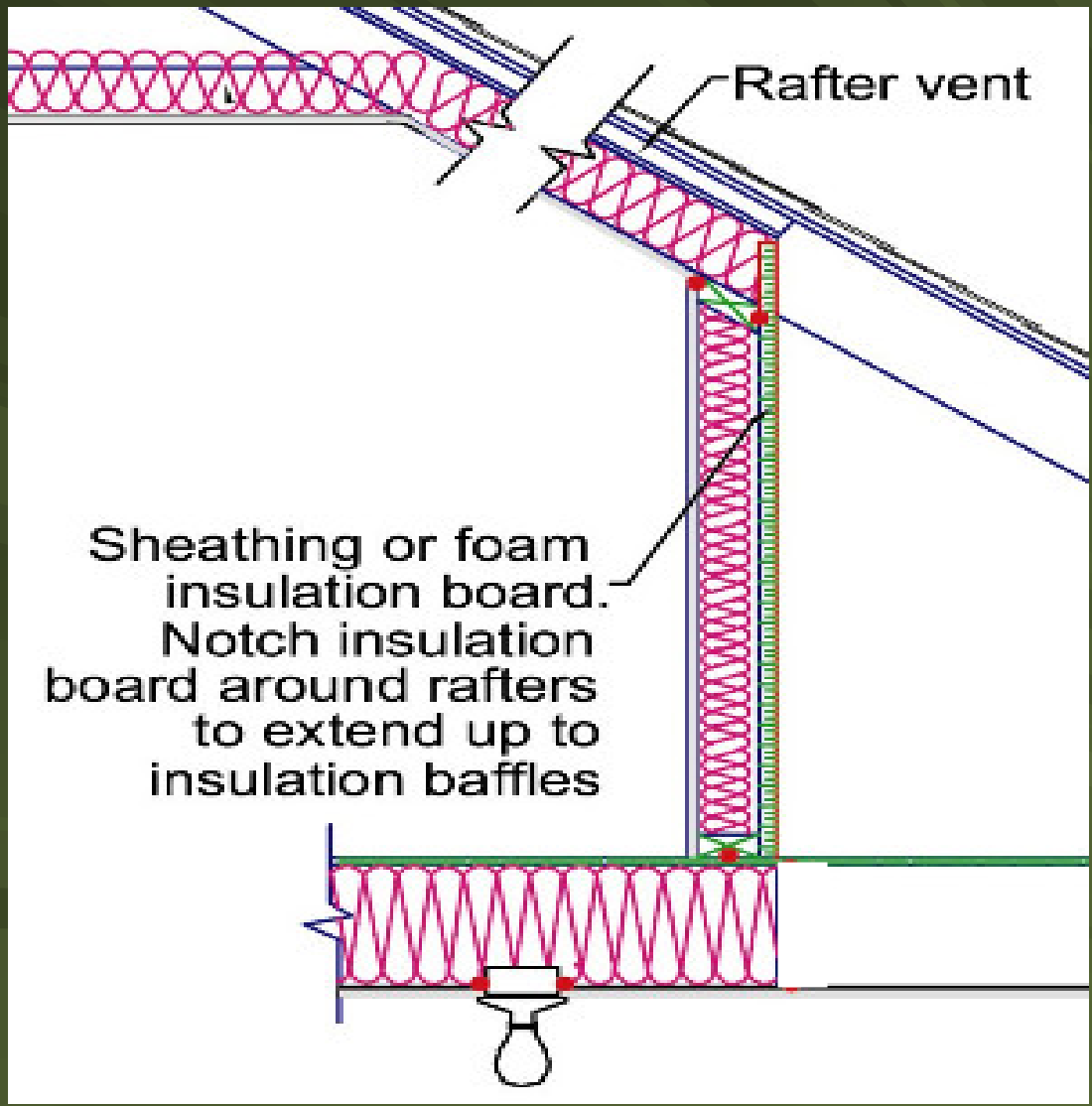
Utility Penetrations

Dropped Ceiling and Chase

Dropped Ceiling and Chase

Knee Walls

Knee Walls


Rafter vent
Sheathing or foam insulation board. Notch insulation board around rafters to extend up to insulation baffles

Knee Walls

Walls and Ceiling separating Garages from dwellings

Behind tubs and showers

Behind tubs and showers

Common Walls between Dwellings

Common Walls between Dwellings

Other sources of infiltration

Other sources of infiltration

Cavity insulation must fill the cavity.

NO Gaps

New Energy Requirements

R703.2: Water-resistive barrier

- **A layer of 15 lb. felt or other approved house wrap must be installed over studs and sheathing of exterior walls**

N1102.4.3: Recessed Lighting

- **IC-Rated and meeting ASTM E 283 ≤ 2.0 CFM leakage *(Air Tight)***

N1102.5: Moisture Control

- **In Zone 4 the vapor retarder is no longer required on insulation in contact with framed walls, floors or ceilings.**

N1103.2.2: Mechanical Systems

- **Ducts, air handlers, filter boxes and building cavities used as ducts shall be sealed. Joints of duct systems shall be made substantially airtight by means of tapes, mastics, gasketing or other approved closure systems.**

Mechanical Systems

N1103.2: Mechanical Systems

- **Supply and return ducts shall be insulated to a minimum of *R*-8.**

*** Exception: *R*-6 is allowed to be used in open-web truss floor systems.**

N1103.2.3: Mechanical Systems

- **Building framing cavities shall not be used as supply ducts.**

N1103.3: Mechanical Systems

- **Mechanical system piping capable of carrying fluids above 105°F or below 55°F shall be insulated to a minimum of *R*-2.**

N1103.4: Mechanical Systems

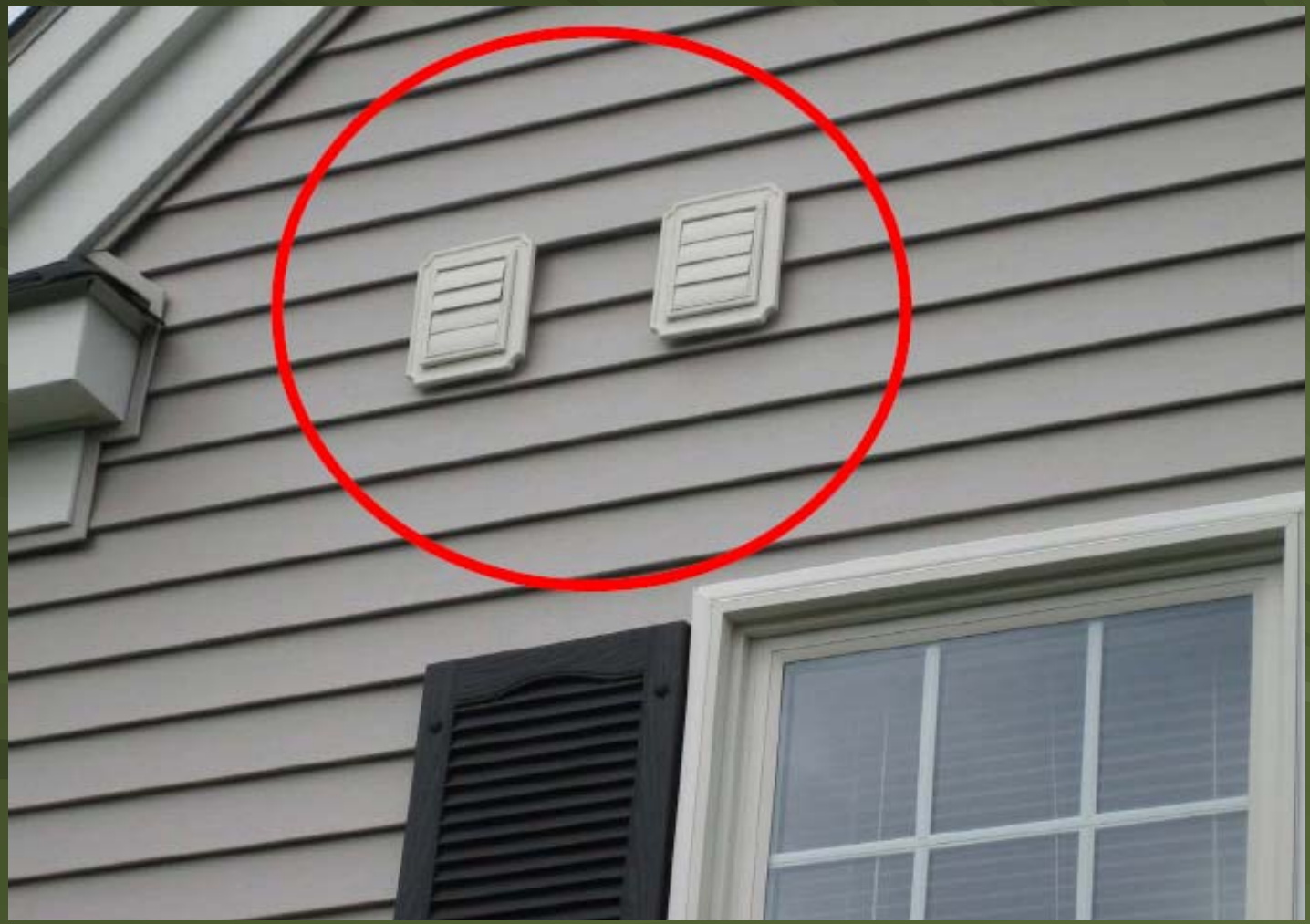
- **All circulating service hot water piping shall be insulated to at least *R*-2. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.**

Mechanical Systems

N1103.5: Mechanical Systems

- **Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.**

Mechanical Systems



Mechanical Systems

N1103.6: Mechanical Systems

- **Heating and cooling equipment shall be sized based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies.**

*** Note: HVAC contractors will need to maintain these calculations.**

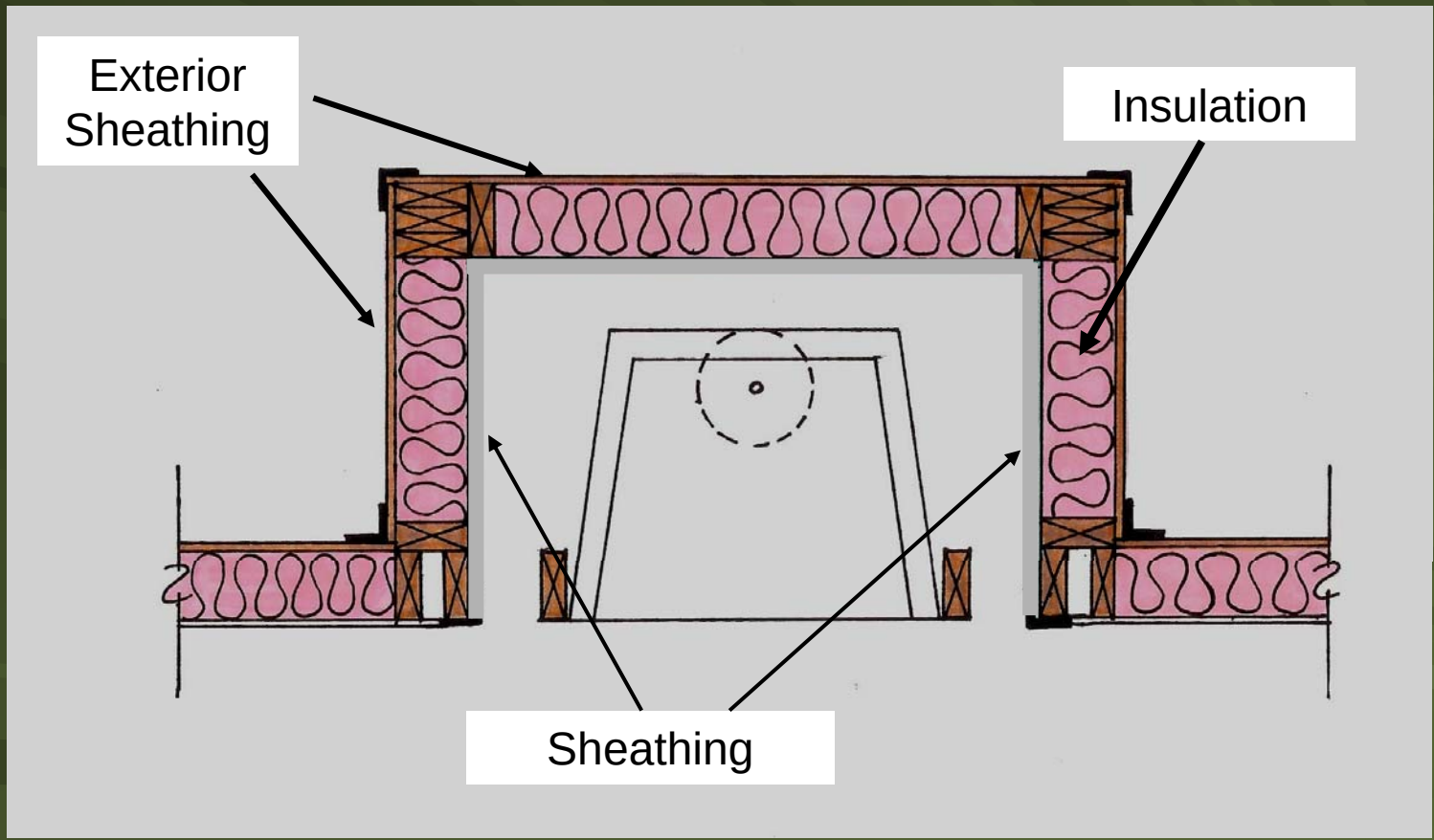
Appliance Standard

- **Water Heaters, Heat Pumps, Air Conditioners and other appliances must meet Federal minimum energy efficiency standards.**

Tubs and showers on exterior Walls

1 2 3

Exterior Wall Around a fireplace



Attic Access opening must be insulated

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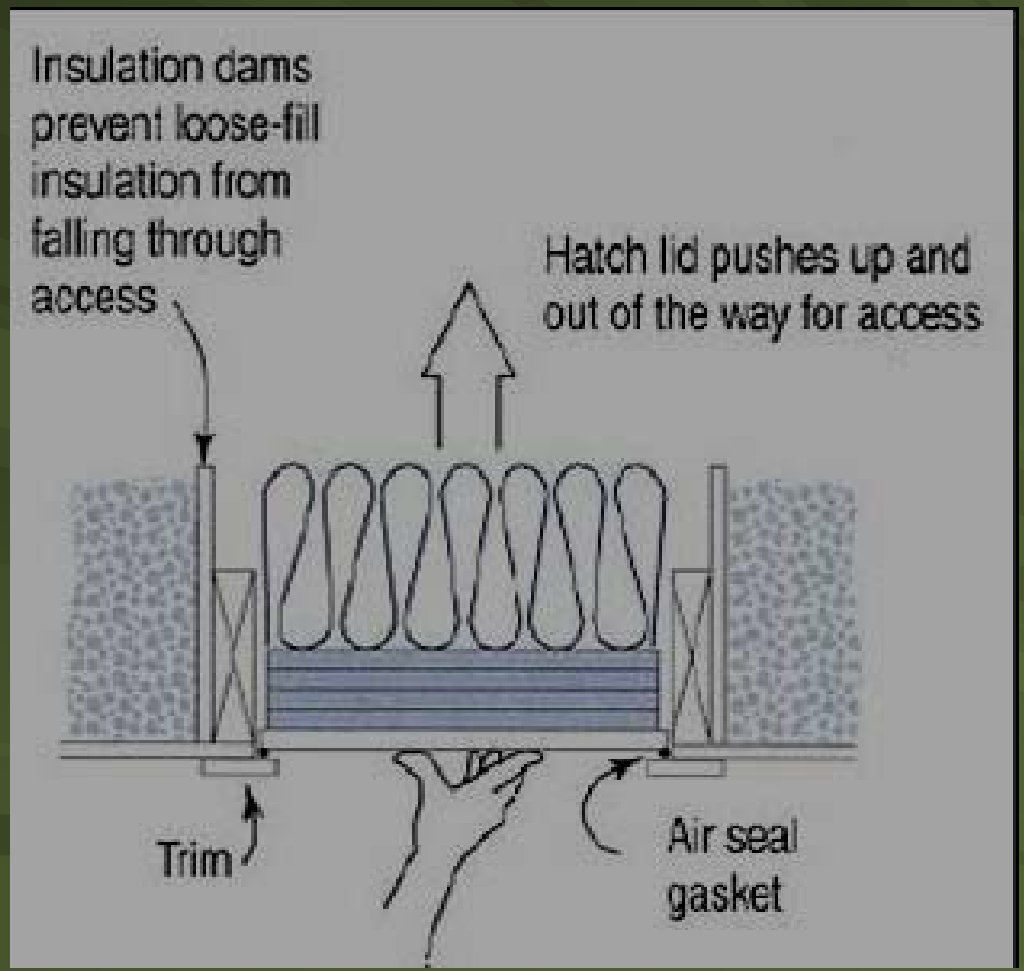

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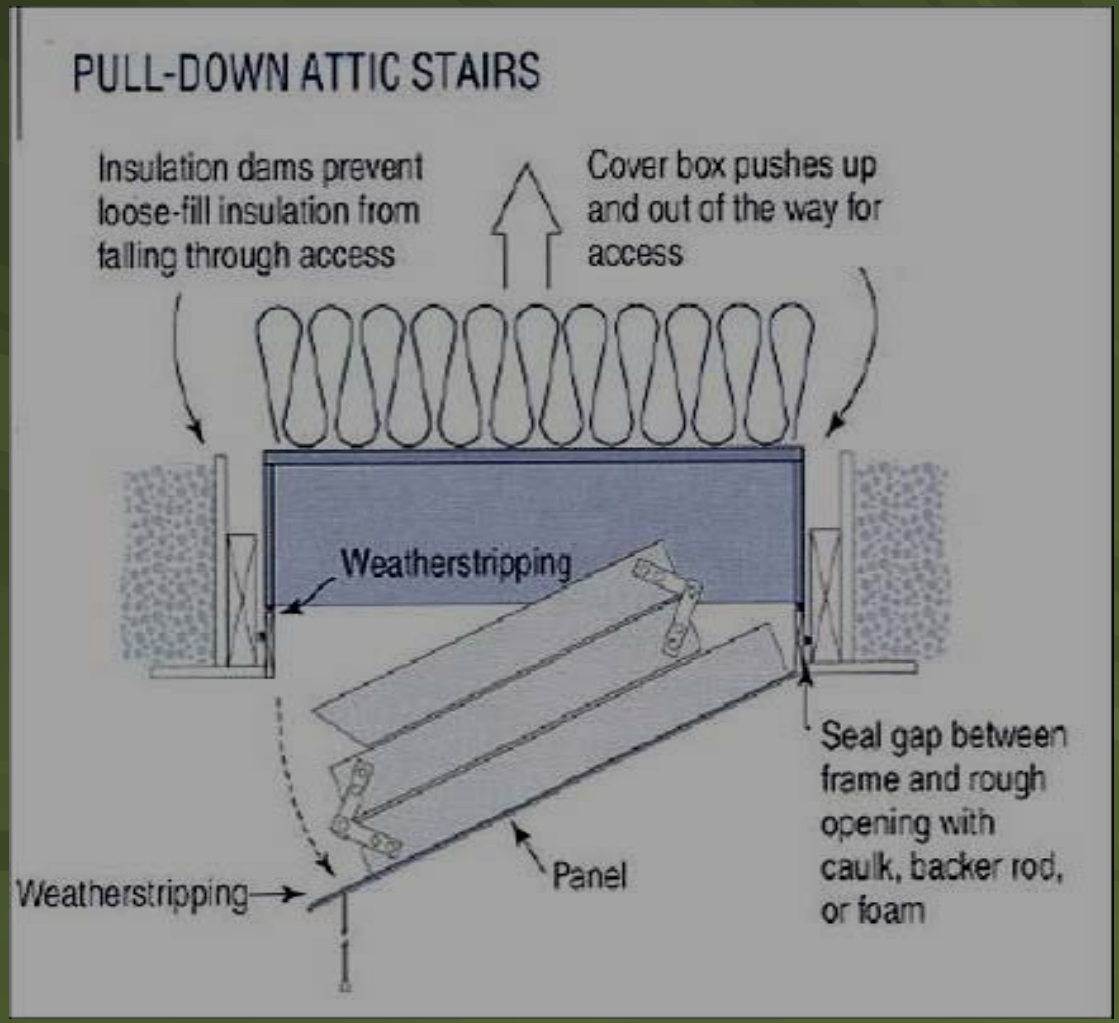

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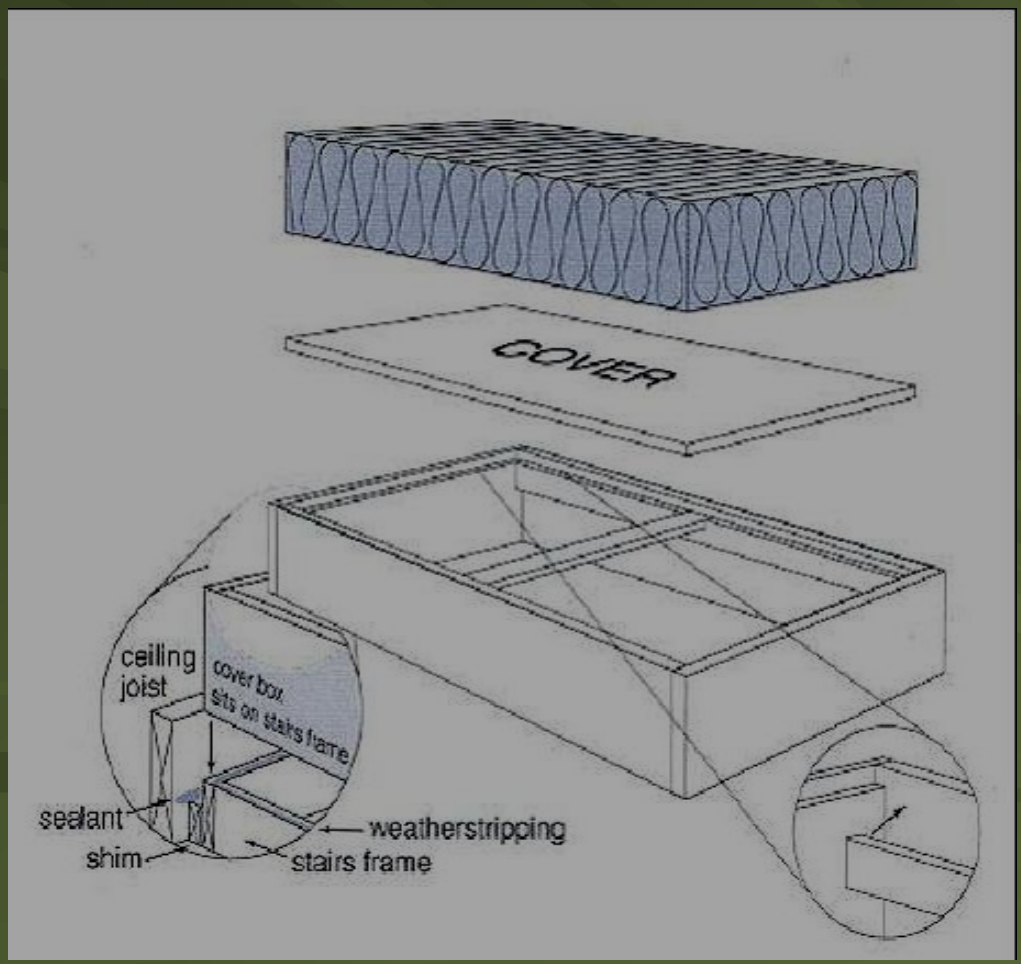

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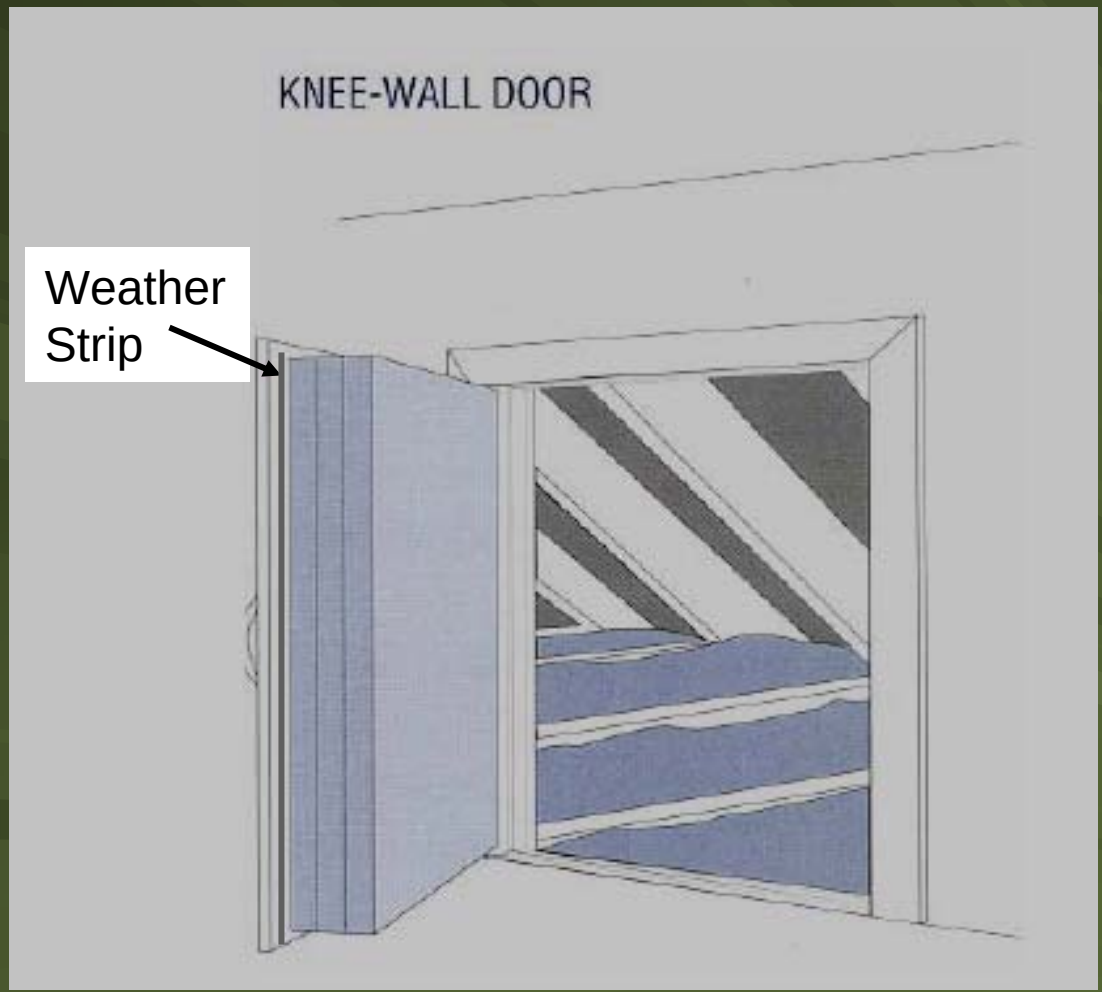

Attic Insulation

- Blown or sprayed
  - **Must have a marker every 300ft^2 showing the depth in inches of the attic insulation**

Markers every 300ft^2

N1101.8: Certificate

- **A permanent certificate shall be posted on or in the electrical distribution panel listing all insulation R-values, fenestration U-values, R-value of insulation for ducts located outside the thermal envelope, and the type and efficiency of heating, cooling and service water heating equipment.**

Energy Efficiency Certificate

Post in or on the electrical distribution panel

Insulation	R- Values
Ceiling / Roof	
Walls	
Foundation: Slab	
Foundation: Basement wall	
Foundation: Crawl space wall	
Foundation: Crawl space floor	
Ducts outside conditioned space	
Fenestration	**U factor / SHGC**
Doors	
Windows	
Equipment	**Efficiency Rating**
Heating	
Cooling	
Service water heating	

Links

ICC website: www.icccsafe.org
VBCOA website: www.vbcoa.org
Chesterfield: www.chesterfield/bi.gov
Department of Energy: www.eere.energy.gov
U.S. Green Building Council: www.usgbc.org
Virginia Sustainable Building Network: www.vsbn.org
Energy Star: www.energystar.gov
EarthCraft House: www.earthcrafthouse.com

Note: There is a Virginia 2006 IRC and other I code books available for purchase at the ICC website.